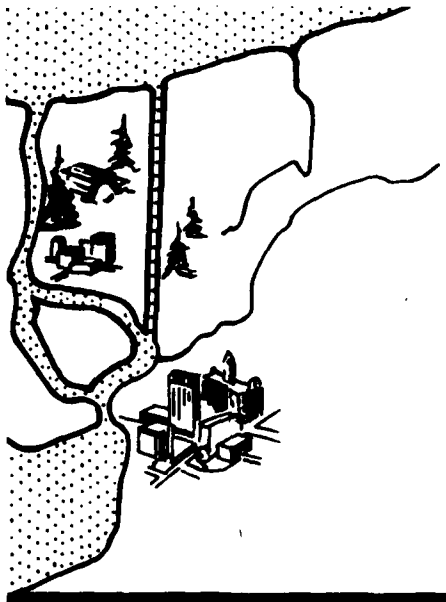
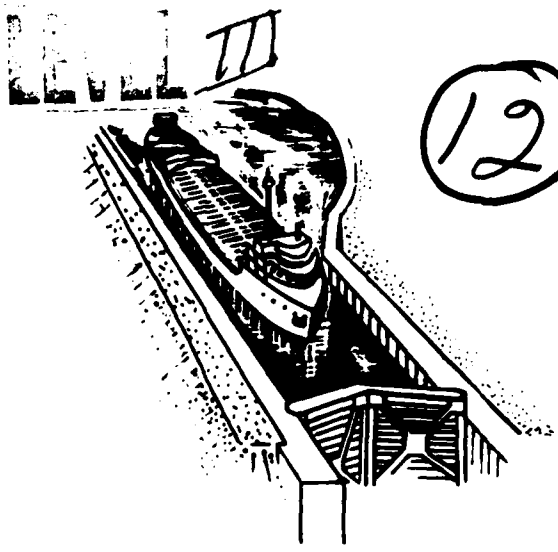
AD-A100 749 CORPS OF ENGINEERS BUFFALO N Y BUFFALO DISTRICT F/G 13/2
REVIEW OF REPORTS ON LAKE ERIE-LAKE ONTARIO WATERWAY, NEW YORK.--ETC(U)
OCT 73 K M DUKE, J K BAKER, R D BURKETT

UNCLASSIFIED NL

1 OF 1
AD A
100749





REVIEW of REPORTS

on

LAKE ERIE - LAKE ONTARIO WATERWAY N.Y.

APPENDIX E

IMPACT ASSESSMENT AND ENVIRONMENTAL PLAN

U.S. ARMY CORPS OF ENGINEERS
BUFFALO DISTRICT

OCTOBER 1973

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A100 747	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Review of Reports on Lake Erie-Lake Ontario Waterway, New York	5. TYPE OF REPORT & PERIOD COVERED Final
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Corps of Engineers 1776 Niagara Street Buffalo, New York 14207	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Corps of Engineers 1776 Niagara Street Bufaalo, New York 14207	12. REPORT DATE 1973
	13. NUMBER OF PAGES 90
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*	15. SECURITY CLASS. *(of this report)*
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT *(of this Report)* Distribtuion Unlimted	
17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*	
18. SUPPLEMENTARY NOTES	
19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)* Lake Erie Lake Ontario Navigation Waterborne Commerce	
20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)* The purpose of this review is to examine the conclusions from the environmental, engineering and economic studies of the construction of a water way between Lake Erie and Lake Ontario in the United States. This report will also serve as a basis for further action by Congress.	

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

IMPACT ASSESSMENT AND ENVIRONMENTAL PLAN FOR THE LE-LO WATERWAY

prepared for

U.S. ARMY CORPS OF ENGINEERS
BUFFALO DISTRICT

by

Battelle Columbus Laboratories

K. M. Duke, J. K. Baker, R. D. Burkett,
T. E. Carroll, D. L. Maase, D. E. Manty,
J. L. Moore, S. E. Rogers, M. L. Warner

Contributors

Charles Rodman
Ramona Mayer
Michael Hughes
Wayne Allton
Phillip Mohler

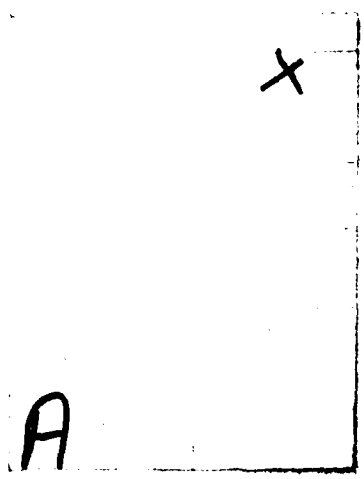


TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF TABLES
(Continued)

LIST OF TABLES
(Continued)

LIST OF FIGURES

INTRODUCTION

E-1 General

Man lives in and is a part of a system comprised of two basic components – living organisms and the nonliving physical and chemical environment. He is dependent upon this system for clean air and water, food, living space, and those resources which can improve his quality of life. Man's powerful technology has enabled him to manipulate these resources according to his desires and needs. However, as his demands (usually characterized by narrow economic objectives) on these finite resources have increased, his attempts at manipulation have often resulted in damage to the very system which provides him with the necessities and luxuries of life. It is apparent that projects proposing to develop and alter these finite resources must consider all aspects of the system – economic as well as cultural, socioeconomic, ecological, and physical and chemical – to insure that limited short-term gains are not outweighed by the long-term detrimental impacts.

E-2 Objectives of Study

This report presents the results of an environmental feasibility study by Battelle-Columbus of the proposed LE-LO Waterway Project. While it is in keeping with the basic intent of the National Environmental Policy Act of 1969, it is not intended to fully respond to all the requirements of that law. Instead, it is designed to assist decision-makers in deciding whether additional planning funds should be allocated to this project.

Two objectives were associated with the research performed by Battelle-Columbus for the Corps of Engineers, Buffalo District. The first was to provide an objective environmental impact assessment of the proposed LE-LO Waterway Project designed to connect Lake Erie with Lake Ontario. To achieve this goal, the baseline environment without the project was described. The canal project was then superimposed on this baseline and the environmental impacts were predicted. The impacts were organized into four major categories – physical and chemical, socioeconomic, ecological, and recreational and cultural – and the magnitude and significance of each impact was evaluated.

The second objective was to develop environmental and recreational plans. The environmental plan was designed to reduce or eliminate the adverse environmental effects; the recreational plan to capitalize on the recreational potential associated with the project.

E-3 Important Considerations of the Study

Construction of the LE-LO Waterway, often referred to as the All American Canal, is tentatively scheduled for the mid-to-late 1980's. Because the environment is a dynamic system constantly changing, it was necessary to describe conditions in 1973 and to project them into the future considering the effects of natural changes, urban and regional development, pollution abatement, economic growth, and many other factors. The projections of the baseline environment made by Battelle are based on the best available data for the existing environment and the changes estimated to take place in the future. However, they must be considered only as predictions or estimates of future conditions. Changes impossible to anticipate are quite likely to take place. Should the decision be made to implement this project, it is expected that this analysis would be updated with detailed environmental studies closer to the time for the initiation of construction.

Upon this predicted baseline, a canal with many engineering unknowns was projected. Similar developments such as the Welland Canal and the Robert Moses Hydroelectric Project, both located near the proposed LE-LO Waterway route, were examined for clues to the nature and magnitude of the changes that might result from this project. While the possibility for unforeseen changes remains, it is believed that most of the major impacts associated with the LE-LO Waterway have been detected by this study.

Battelle-Columbus used an interdisciplinary research team of ecologists, engineers, social scientists, environmental planners, and meteorologists to conduct this analysis. There were four basic steps in the approach:

(1) Estimate the baseline environment for the period 1980-2030

(2) Identify all significant impacts resulting from construction and operation

(3) Develop plan for reduction of impacts

(4) Develop recreation plan.

The team used professional judgment, information in the open literature and other reports, personal communication with knowledgeable experts, predictions based on past trends, and personal knowledge of the study area. Wherever possible, the predicted impacts were quantified to improve the accuracy of the evaluation. Qualitative information and professional judgment were used where quantitative data were lacking.

ASSESSMENT OF BASELINE CONDITIONS

E-4 Introduction

The proposed LE-LO Waterway, designed to provide a major transportation link between Lake Erie and Lake Ontario, would be located in Erie and Niagara Counties, New York (Figures E-1 and E-2).[1] A project of this magnitude will cause changes of many types on the national, regional, and local scales. This report will deal with the environmental changes resulting from the construction and operation of the canal. Environmental effects, while occurring on the regional and national scales, are strongest at the local level near the site of the project. Consequently, the local environmental changes, those affecting Erie and Niagara Counties, are examined in depth in this study.

In assessing the environmental changes, it is necessary to describe the baseline environmental conditions that may be altered by the construction and operation of the canal. The objective is to establish and evaluate the baseline condition of the environment, without the canal, for the period 1980-2030. The construction of the canal is expected to begin in the late 1980's with operation following in the early-to-mid 1990's.

The environment is an extremely complex collection of interacting components. In methodically examining the aspects of the environment, a hierarchical approach organizes the environment into four major categories: Physical and Chemical, Ecological, Socioeconomic, and Recreational and Cultural (Figure E-3). Within the hierarchy, each environmental category is composed of components (e.g., Land, Water, Air) each of which contains several indicators (e.g., Geology, Soils, Physiography). The indicators comprise the key level of the hierarchy. The important aspects of the environment are selected as indicators. Detailed information is collected for each indicator and is used to make a quality evaluation of those aspects of the environment included within the indicator. Not every piece of available information nor every aspect of the environment is included in the indicator. Instead, the quality evaluation for each indicator is used as an index for all the aspects related to that indicator. This significantly reduces the complexity of the data presentation and evaluation without losing the accuracy needed in the baseline assessment.

FIGURE E-1. REGIONAL MAP SHOWING LOCATION OF THE ERIE AND NIAGARA COUNTIES STUDY AREA.

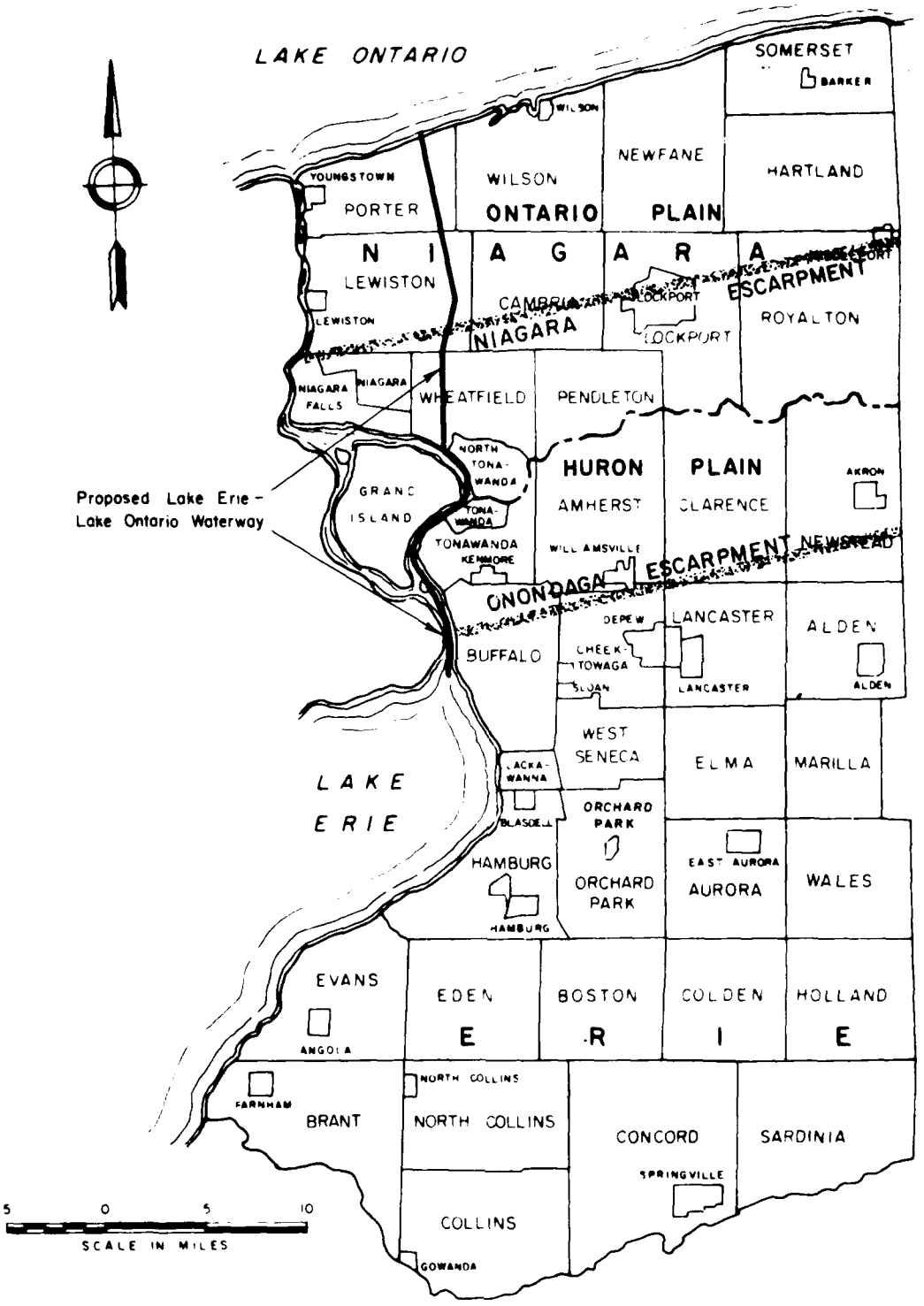


FIGURE E-2. LE-LO WATERWAY STUDY AREA - NIAGARA AND ERIE COUNTIES, NEW YORK.

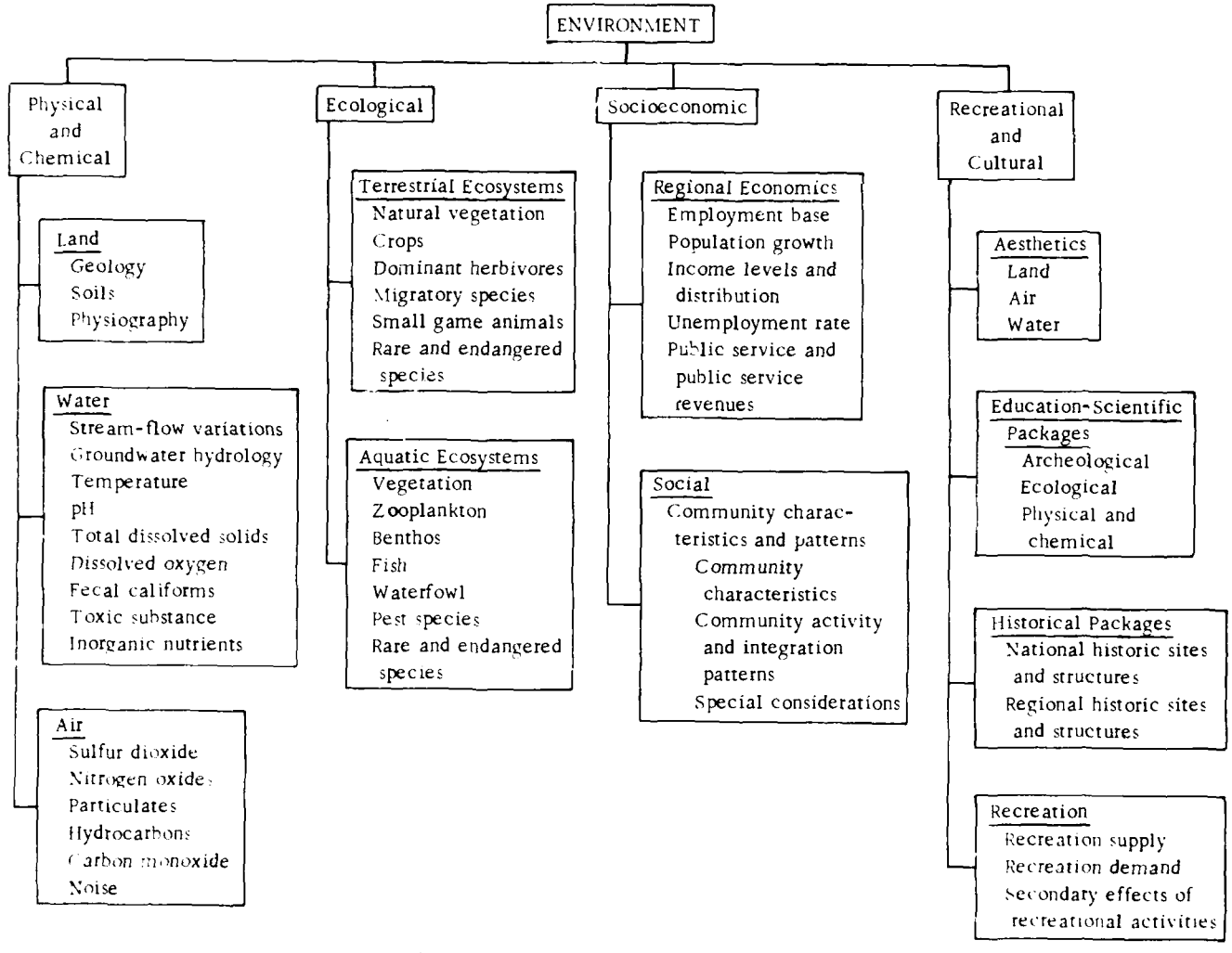


FIGURE E-3. CHART OF HIERARCHICAL SYSTEM

The collected data for each indicator are presented as follows. First, each indicator is described. The importance of the indicator and the data used in the analysis is indicated. Then the baseline projections for 1980-2030, including information on the current or existing trends and conditions and the changes expected to take place during the baseline period, are presented. Only information relevant to the Lake Erie-Lake Ontario Project is utilized in these discussions.

E-5 Physical and Chemical Environment

The Physical and Chemical category is designed to detect impacts on the physical and chemical quality of the land, water, and air sectors of the environment. Traditionally, these were the only classes of impacts considered in assessing the environmental cc. sequences of most projects. This restriction may have stemmed from the fact that most ecological and many social, cultural, and recreational impacts are actually secondary effects resulting from the primary impacts on the physical and chemical environment. Now, however, a variety of impacts, secondary and higher, are also considered. The three components of the Physical and Chemical Environment are Land, Water, and Air. Under each component are several indicators describing the baseline conditions of the component.

E-6 Land

The overland route of the proposed LE-LO Waterway will traverse western Niagara County from a point immediately east of North Tonawanda corporate boundary and extend to the north to the Niagara Escarpment and then north-northwest from the Niagara Escarpment to Lake Ontario.

Three indicators are used under the land component: (1) physiography, (2) soils, and (3) geology. These indicators will not significantly change during the 1973-2030 period.

E-7 Physiography

The overland route may be logically divided into two zones divided by the Niagara Escarpment (see Figure E-2). The southern

leg of the route (≈8 miles) would extend across the Huron Plain while the northern leg (≈8.5 miles) would traverse the Ontario Plain. Surface elevations rise from the Niagara River water edge (mean of 565 feet MSL) through a depressed basin-like area having an imperfectly developed subsurface drainage outlet to about elevation 630 feet MSL at the Escarpment. At the Escarpment, elevations descend in two jumps of 80 and 150 feet, respectively, to 400 feet MSL. North of the Escarpment, elevations descend gradually to a lower plain which steps briefly to a mean Lake Ontario elevation of 245 feet MSL.

Within the Huron Plain, south of the Escarpment, the area under consideration is drained by the southwesterly sloping Bergholtz-Cayuga subbasin. Areas of consideration north of the Escarpment (Ontario Plain) are almost exclusively drained by the northeasterly sloping Twelvemile subbasin. Shore-zone areas along the Niagara River and Lake Ontario yield runoff directly to these surface water features.(2)

E-8 Soils

The soils of Niagara County have developed under a forest cover in which maple, beech, oak, and ash predominated. Along the Niagara Escarpment, the soils have been influenced to some extent by the character of the underlying rocks. In places along the more gradual northern slope of the Escarpment, light grayish-brown soft calcareous shale is reached at a slight depth, and fragments of this shale are present in the subsoil. Farther out on the lake plain, principally north of the ridge, red, soft, easily disintegrated shale lies beneath a thin mantle of soil.

Glacial till (consisting of sharp stone fragments intricately mixed with more finely ground rock material) occurs in places as low broad ridges, most noticeably south of the Escarpment. On the Ontario Plain glacial till occupies mainly large flat areas having no outstanding topographic characteristics.

In addition to differences in soils that correspond to differences in basic parent material, numerous other differences correspond to variations in drainage conditions, which range from a permanently wet condition to excessively rapid drainage. Good surface and internal drainage have resulted in the formation of grayish-brown, yellowish-brown, or brown soils, with slightly lighter but unmottled colors in the subsoil. Soils developed under imperfect drainage conditions have

dark-gray to grayish-brown surface soils and a rust-mottled upper subsoil layer in which the dominant color ranges from light brown to gray. Poorly drained soils are characterized by dark-gray or nearly black surface layers underlain abruptly by light-gray layers that grade into less gray, highly mottled materials.[3]

Soils of particular interest in Niagara County include the Poygon clays, which have value in construction, and the carlisle muck soils, which have great agricultural value (Table E-1).[3]

TABLE E-1. ACREAGE OF TWO IMPORTANT SOILS AND THEIR PROPORTIONATE EXTENT OF THE TOTAL LAND IN NIAGARA COUNTY, N. Y. (341,120 ACRES)[3]

Type of Soil	Acres	Percent of Total
Carlisle muck	1,152	0.3
Carlisle muck – shallow phase	1,664	0.5
Poygon clay	26,240	7.7

E-9 Geology

The study area is underlain by layers of sedimentary bedrock that are largely covered with unconsolidated deposits. The bedrock consists mainly of dolomite, shale, limestone, and sandstone. The Camillus Shale contains a large amount of interbedded gypsum. The unconsolidated deposits are mostly glacial and consist of till (unsorted mixture of clay, silt, sand, and stones); followed by postglacial lake deposits (bedded clay, silt, and sand); and glacial stream deposits (sand and gravel). Glacial sand and gravel deposits are of both ice contact and outwash types.[4]

The bedrock surface is approximately parallel to the land surface throughout most of the area. South of the Niagara Escarpment, the top of the rock lies 3 to 50 feet below land surface (average 23 feet). On the lake plain north of the Escarpment, depth to rock varies from 10 to 120 feet, commonly 30 to 40 feet. The few irregularities in the surface of the bedrock appear to be due to minor features shaped by glacial or preglacial erosion. The inclination of the bedding planes (dip of the rocks) is gently southward at from 20 to 60 feet per mile, averaging 30 to 40 feet per mile.[5]

E-10 Water

The major surface water features of the study area are Lake Erie, Lake Ontario, and the Niagara River connecting the two lakes. The differential in water surface elevations between the lakes is about 326 feet. About 86 percent (202,000 cfs) of the inflow of Lake Ontario passes through the Niagara from Lake Erie. The upper Niagara River (≈21 miles long) between Lake Erie and downstream of Grand Island drops about 10 feet, descends another 45 feet in prefall rapids, and then plunges majestically 165 feet over the Niagara Falls. The lower Niagara River, well contained in the eroded Escarpment, drops an additional 100 feet in less than 6 miles. The slope of the remaining lower Niagara is about 1 foot per mile.

Numerous streams discharge to the upper Niagara River. The largest subbasin discharging to the east fork of the Niagara River, Tonawanda-Ellicott Creek, contributes only about 0.1 percent (net yearly average about 218 cfs) of the Niagara flow. The treaty-controlled diversions by Canada and the United States for developed hydroelectric projects have essentially no effect on the overall Niagara basin water budget.

Stream flow of the Niagara has ranged from 90,000 to 299,000 cfs for the period of record and averages 202,000 cfs. Since the Niagara River is essentially a connector of Lake Erie and Ontario, seasonal variations are insignificant in comparison with the not-well-understood 9-11 year normal surface fluctuations of the Great Lakes. Diurnal changes in the discharge of the Niagara River are caused by changes in the wind direction over Lake Erie or ice jams in the river.[6]

The proposed overland route of the LE-LO Waterway traverses two drainage systems: the Cayuga-Bergholtz Creek subbasin New York Stream Class D and C up-to-downstream (Class D is used for agricultural or industrial purposes and Class C is less polluted suitable for fishing but not body contact or drinking) south of the Escarpment and the Twelvemile subbasin Class D, C and B up-to-downstream (Class B is suitable for body contact but not drinking) north of the Escarpment.[7] Lesser streams, discharging directly into the Niagara River and Lake Ontario, will also be affected. However, with respect to the proposed development of the LE-LO Waterway, consideration of alteration of surface water features along the overland route of the canal will be constrained to projected impacts on Twelvemile Creek and Bergholtz Creek proper.

It is important to note that present conditions of potentially affected headwater zones of Cayuga-Bergholtz and Twelvemile subbasins can not be directly documented. The water quality of the Cayuga-Bergholtz system greatly deteriorates on its course to the Niagara and is quite responsive to stream flow changes. Headwaters are expected to be of the calcium bicarbonate type characteristic of groundwater inputs permeating through calcarious or dolomite terrain. In addition, gypsiferous Camillus Shale aquifer exposures contribute calcium and sulfate ions. Along its course to the Niagara, quantities of raw or only partially treated sewage, nutrients from agricultural operations, periodic dumping of salt-laden snow, and streamwater runoff from developed areas contribute to the deterioration of surface water quality. Waters of the Twelvemile subbasin of concern are expected to be less affected by man's uses with the exception of inputs of agricultural runoff and, to a lesser extent, municipal effluents (domestic and industrial).

Of concern to both dredging during construction and quality of water entering the proposed LE-LO Waterway during operation would be the discharges from Buffalo River and Scajaquada Creek through the Black Rock Canal and Lock and, more importantly, net discharges from the Tonawanda-Ellicott subbasin. A recent study indicates that massive sludge deposits are found to accumulate in lower Tonawanda Creek, especially during periods when net flows from the system are through the Erie Canal.(8)

Oxygen concentrations have been reported to drop to near zero, demonstrating that effluents have far exceeded natural assimilating capacity of the aquatic system. These oxygen-demanding sediments are reportedly resuspended and carried directly into the Niagara in bulk quantities during seasonal near-flood conditions, thus degrading the northern nearshore water quality of the east branch of the Upper Niagara River and, to a lesser extent (due to dilution), the lower Niagara River.(7)

Past deleterious water-quality conditions are confirmed by reported Niagara River sediment chemistry analysis. Areas demonstrating worst-case conditions along the proposed canal route are the man-made Black Rock Canal and Lock and the nearshore zones of the Niagara River proper. Generally, those areas influenced by discharges from the Buffalo River and numerous contaminated effluents discharged along the entire Niagara River's eastern shore can be considered heavily polluted. Mainstream sections of the east branch of the Niagara River may be considered lightly to moderately polluted.(7) Table E-2 indicates concentration of sediment pollutants of the areas

of concern to both proposed dredging operations and water quality during canal operation.

TABLE E-2. SEDIMENT CHEMISTRY OF PROPOSED WATERWAY ROUTE[a]

(mg/l)

	Black Rock Canal	Tonawanda "Channel" (Mainstream)	Eastern Shore Zone
Volatile solids	100 ± 5	50 ± 20	80 ± 25
Oil and grease	7.5 ± 2.5	0.75 ± 0.50	8 ± 2
COD	140 ± 15	6 ± 2	110 ± 30
Total nitrogen	2.5 ± 1	0.5 ± 0.1	1.4 ± 0.4
Total phosphorus	1.0 ± 1	0.05 ± 0.05	0.8 ± 0.1
Iron	45 ± 15	--	--
Mercury	--	0.05 ± 0.01	0.2 ± 0.1
Lead	--	0.03 ± 0.01	0.6 ± 0.01
Copper	--	0.02 ± 0.01	0.6 ± 0.01
Zinc	--	0.06 ± 0.01	0.2 ± 0.05

(a) Extrapolated data.

E-11 Stream Flow Variations

The nature and magnitude of stream flow variations are major factors governing the type of ecological system that will develop and survive in a given water course. If the pattern of stream flow variation is changed markedly, a subsequent disruption of the ecosystems may result.[8]

Of concern to an analysis of flow-variation alternatives with respect to the proposed development is the aforementioned Twelvemile and Bergholz-Cayuga subbasins (drainage areas 31.7 and 32.4 square miles, respectively). Annual surface water runoff from these subbasins is about 45 to 50 percent of the rainfall and ranges from no flow for prolonged periods devoid of precipitation to a maximum of about 200 cfs per square mile for the 50-year flood. Usually from 40 to 50 percent of the annual runoff occurs in the March to April period, about 10 to 15 percent in May and June, 5 to 10 percent from July through October, and about 30 to 40 percent from November through February.[9]

E-12 Groundwater Hydrology

Actions that influence groundwater levels have the potential of affecting both supply and water quality.

In areas where groundwater aquifers are considered as primary natural reservoirs, such alterations will influence surface water supplies. Corresponding alterations of the aquatic ecosystem may occur, thus affecting water-dependent users, including man.

The Lockport Dolomite is the only important aquifer potentially affected by the proposed canal. Groundwater within this aquifer occurs in three types of openings: bedding joints, vertical joints, and small cavities. Of these, the bedding joints are the most important and transmit nearly all the water moving through the formation. The character of the three types of water-bearing openings results in two distinct sets of groundwater conditions: (1) a moderately permeable zone at the top of rock, generally 10 to 15 feet thick, characterized by both vertical joints and bedding joints that have been widened by solution of dolomite and by small cavities formed by solution of gypsum and (2) the remainder of the formation consisting of seven permeable zones (composed of bedding joints) surrounded by essentially impermeable rock. Recharge to the water-bearing zones apparently occurs directly at the outcrop of the bedding joints composing the zones rather than by downward movement of water through vertical joints. Usable groundwater is characteristically a calcium sulfate or calcium bicarbonate water.

The chief use of groundwater in the area is for small domestic and farm supplies in the rural sections. Small to moderate supplies of groundwater (5 to 150 gallons per minute) may be obtained throughout the area underlain by the Lockport Dolomite. Large supplies of groundwater (exceeding 2,000 gallons per minute in some wells) have been obtained adjacent to the Niagara River where conditions are favorable for river infiltration. In areas underlain by Queenston Shale, development of even the very small supplies needed for domestic and farm use is difficult.[5]

E-13 Temperature

Water temperature is important primarily because of the sensitivity of fish and aquatic life to temperature changes. In addition, alterations influence aquatic-dependent ecosystems including human uses. This indicator should be considered with respect to potential

aggregate temperature effects, e.g., magnitude of departure from normal conditions.[10]

With respect to Twelvemile and Cayuga-Bergholtz subbasin, insufficient direct data are available to allow documentation or baseline projection of normal temperature fluctuations in the areas of concern to the proposed project. However, based on indirect measurement, it may be stated that flowing headwater zones of the subbasins probably have extremes of 0 and 22 ± 2 C, respectively. The Niagara River and Lake Ontario shore-zone water temperature of concern ranges from 0 to 25 C.[11]

E-14 pH

Although pH (measure of the hydrogen ion concentration) affects the suitability of water for various uses, a good measure of its impact on environmental quality is its effect on fish and other aquatic life. Since the normal pH of aquatic ecosystems varies from one locale to another, the best measure of pH is in terms of departure from normal levels.[10]

With respect to Twelvemile and Cayuga-Bergholtz subbasins, insufficient direct data are available to allow documentation or baseline projection of pH fluctuations in the area of concern to the proposed project. However, at the confluence of Bergholtz and Cayuga Creeks the surface water is considered to be "heavily polluted" and probably has pH fluctuations exceeding the 6.7 to 8.5 range. The pH fluctuations within the Twelvemile subbasin are expected to be within this range.[11]

If present pollution-abatement trends continue, the waters at the discharge of the Cayuga Creek to the Niagara would be expected to be within the above pH range.[12] Normal pH fluctuations of Lake Ontario shore-zone waters of concern are expected to be well within this range and positively skewed.

E-15 Total Dissolved Solids

The concentration of total dissolved solids (TDS) is the aggregate of magnesium, sodium, and potassium carbonates, bicarbonates, chlorides, sulfates, phosphates, nitrates, and other salts. All salts in solution (total and proportions) influence the physical and chemical nature of the water.[10]

Although no information is available to allow documentation or projection of TDS loading in the headwater zones, the discharge of the Cayuga is presently considered "heavily polluted" in this regard. In the past, total loading to the waters of the Niagara have exceeded 450 tons per day on the average. Presently, loadings have been reduced to 350 tons per day. If pollution-abatement trends continue, the objective of reaching an average TDS value of 200 ppm in the shore zones of the upper Niagara River may be anticipated before 1980.[11,12]

E-16 Dissolved Oxygen

The saturation concentration of dissolved oxygen (DO) in water depends on water temperature and on dissolved solids content. Low levels of dissolved oxygen adversely affect fish and other aquatic life; total absence of dissolved oxygen will lead to an anaerobic condition with attendant odor and aesthetic problems in addition to the absence of higher forms of aquatic life.[10]

The outfall of Cayuga Creek is reported to be moderately polluted in this regard. No direct information is available to characterize the upper watershed of Bergholtz and Twelvemile Creeks. If abatement trends continue, the Niagara waters of concern and the discharges from Cayuga-Bergholtz subbasins should reach the objectives of 6 ppm (DO) before 1980.[11, 12] Levels of DO of nearshore waters of concern in Lake Ontario are expected to range between 95 and 105 percent saturation.

E-17 Fecal Coliforms

The presence of coliform organisms in water is regarded as evidence of fecal contamination. Importance of coliform data continues because of existing implications that viral diseases can be transmitted directly (and possibly indirectly) through the fecal contamination of water supplies.[10]

Discharge waters of the Cayuga Creek and waters along the American shore of the upper Niagara River can be considered "heavily polluted" in this regard with coliform counts exceeding 2,000 coliforms per 100 ml over twice the acceptable counts. Concentration of coliforms in headwater zones of the subbasins of concern cannot be documented. However, the objective of 1,000 coliforms per 100 ml for the shore waters of the Niagara and discharges thereto should be reached

before 1980.[11,12] Coliform counts of Lake Ontario shore waters of concern are not expected to exceed 1000 per 100 ml.

E-18 Toxic Substances

The spectrum of toxic materials is extremely large and highly diverse in terms of effects. Since knowledge of effects is extremely limited, and potentially dangerous concentrations can go undetected by the current standard water-quality analysis methods, it seems that a reasonable environmental goal is to eliminate the transport of these materials within the biosphere.[10]

Predominant substances (considered as toxic) transported by the Niagara River system are heavy metals and hydrocarbons. Pollution-abatement programs are concentrating on two major toxic substances: phenols and iron. If pre-1980 objectives are obtained, concentrations of phenols and iron from discharges to and near shore zones of the upper Niagara should be maintained below 1 ppb and 0.3 ppm, respectively.[11,12] Projection of toxic substances in the nearshore waters of Lake Ontario and the upper watersheds of the subbasins of concern is not presently possible. However, during the operation period of the Waterway they are not expected to be measurable by standard procedures.

E-19 Inorganic Nutrients

Carbon, nitrogen, and phosphorus are three basic elemental nutrients needed to sustain aquatic life.

Available information indicates phosphorus concentrations greatly exceed desirable levels predominantly along the U. S. shore zones of the upper Niagara River. Pollution-abatement programs are concentrating on phosphorus and should reduce annual total phosphorus loading to below 0.39 grams per square meter by 1980.[11,12] No direct information is available to allow projection of the organic nutrients within the nearshore waters of Lake Ontario or of the subbasins of concern.

E-20 Air

The area of concern to the project has a moist continental climate characterized by moderate annual precipitation and an annual temperature range governed primarily by the basin's distance north of

the equator. The Westerlies that prevail in these latitudes are generally dry upon reaching the eastern states. Moisture enters the area mainly in frontal systems. Seasonal cold, dry, polar air moves from the northern latitudes and warm, moist air moves northward from the Gulf of Mexico.

Lake Erie has a moderating effect on temperature and also provides additional moisture to the air passing over it. The air from the Gulf during the summer months is generally the dominating influence on precipitation south of the Escarpment. Rainfalls are intense yet relatively infrequent. During the winter, however, polar air circulates farther south, and periods of precipitation in the area are more frequent. Total annual precipitation for the area ranges from 32 to 44 inches. Evapotranspiration losses account for about 20 inches. The remainder of the water budget of the region appears as surface and groundwater runoff (see Section E-12).[13]

The climate of Niagara County north of the Escarpment is influenced to a marked degree by its proximity to Lake Ontario. Seasonally, when the wind is passing over Lake Ontario, the temperature of the air is modified so that it tempers the heat of summer and the cold of winter. The Escarpment is also a factor in the creation of a notable mild microclimate in this area. Annual snowfall in the Lewiston area can be as much as 30 inches less than the annual snowfall in Buffalo, only 30 miles south. Buffalo receives seasonally the brunt of wind and precipitation blowing unobstructed across Lake Erie, while the northern plains protected by the Escarpment enjoy more even weather conditions.[14] As a result, the spring season is retarded and the fall extended.

The area of concern to the development of the LE-LO Waterway is incorporated into Niagara Frontier Air Quality Control Region (AQCR), one of the seven upstate New York Air Quality Control Regions. This AQCR has been classified as Priority I, indicating that highest concentrations of air pollutants are being experienced.[15] The following discussion of air-quality indicators reflects areas of highest pollutant concentrations within subregions of the Niagara Frontier AQCR that may be expected to influence the ambient air quality along the proposed canal route.

E-21 Sulfur Dioxide

Sulfur dioxide contributes to the formation of sulfate particles or droplets of dilute sulfuric acid. In these states, increasing

sulfur concentrations have been associated with synergistic health effects.[10]

Sulfur dioxide concentrations in four areas of Niagara and Erie Counties exceed both the national primary and secondary annual average standards of 0.03 and 0.022 ppm (0.073 ppm in South Buffalo-Lackawana, 0.038 ppm in Niagara Falls, 0.036 ppm in Tonawanda-North Tonawanda, and 0.033 ppm in Lockport). If present air-pollution-abatement trends continue, Niagara Falls and Lockport areas will be complying with secondary standards in the 1980-1985 period. However, for the same period, the New York State Department of Environmental Conservation has asserted that achievement of secondary standards would not be economically feasible for the South Buffalo-Lackawana and Tonawanda-North Tonawanda areas.[14]

E-22 Nitrogen Oxides

Nitric oxide (NO) forms during high-temperature combustion, e.g., automobile engines. It then reacts with oxygen to form nitrogen dioxide (NO_2), which forms photochemical smog when in the presence of hydrocarbons and particulates.[10]

The Buffalo area of Erie County exceeds primary and secondary standards of 0.05 ppm annual average concentrations. Emissions for 1975 are projected to 72,377 tons, assuming no industrial expansion. If air-pollution-abatement trends continue, the average annual Federal standard for nitrogen dioxide (0.05 ppm) is expected to be obtainable prior to 1980.[15]

E-23 Particulates

Suspended particulate matter, often referred to as "particulates", is the most prevalent atmospheric pollutant. Larger particles tend to settle out of the air. Particles smaller than 1 micron are most readily respirable and contribute the most to reduction of visibility. Particulate concentrations are usually reported with respect to a range of 1 to 10 microns.

The three areas of severe suspended particulate concentrations are South Buffalo-Lackawanna, Tonawanda-North Tonawanda, and Niagara Falls.[10] Highest annual average concentrations in these areas in 1971 were reported as 166, 95, and 215 $\mu g/m^3$, respectively. Projections by the New York State Department of Environmental

Conservation indicate that it will not be economically feasible for South Buffalo-Lackawana and Niagara Falls areas to meet secondary standards of 60 $\mu g/m^3$ even by 1985. Zones of heaviest concentrations in these areas are still expected to exceed 95 $\mu g/m^3$ quality through 1975. If present air-pollution-abatement trends continue, compliance with primary standards (75 $\mu g/m^3$ – annual average) may be anticipated by 1980.[12, 15]

E-24 Hydrocarbons

Unburned hydrocarbon pollutants are most often petroleum products, with automobile exhaust as the major source. Their most important role is as oxidant precursors in the formation of photochemical smog.[10]

Whether the area will meet national primary and secondary standards of 0.24 ppm (allowable max 6-9 a.m.) before 1980 will depend primarily on the time frame required for replacement of older uncontrolled motor vehicles by stringently controlled newer vehicles.[15]

E-25 Carbon Monoxide

Carbon monoxide is a colorless, odorless, tasteless gas formed by the combustion of carbonaceous fuels (eminates primarily from automobile exhausts.

Whether the standard, 0.9 ppm (8-hr max), is met before 1980 will depend on vehicle turnover, coupled with stringent exhaust-emission limitations on newer vehicles.[15]

E-26 Noise

The importance of noise as an environmental factor has been well documented by the United States Environmental Protection Agency in its Report to the President and Congress on Noise, published in December, 1971.[16] This report outlines such direct effects of noise on man as hearing, physiological, nonauditory, psychological, and sociological effects. The report also describes some of the effects on wildlife and other animals. Noise also has indirect economic effects in that it can cause people to reject certain areas of land as suitable for habitation or other uses.

One of the factors which determines how much an area is affected by a new noise source is the existing noise climate. In practically any area of the earth there are natural sources of noise. Even in the absence of man, who has sometimes been accused of being the noisiest animal on earth, there are sounds from flowing water, wind, grinding of glaciers, and many other sources. In areas where man is active, there are sounds of industry, commerce, transportation, and recreation. The extent to which a new sound affects the area surrounding it is determined by the loudness, character, and frequency and duration of occurrence relative to the previously existing sounds.

Existing moderate-to-high level noise sources near the canal route include the Niagara Falls International Airport. The canal is within the 100-decibel range of perceived noise created by this airport.[17] Other important noise sources near the canal include highways and railways. The heavily travelled highways include River Road (State Route 265-384) and Niagara Falls Blvd. (Federal Route 62). Average daily traffic on these routes range from 15,120 vehicles per day on Route 62 to 17,920 on New York Route 265-384.[18] Three railways cross the canal route. The northernmost crossing, a Penn Central line passing near Ransomville, carries little traffic.[18] The other two, a Penn Central line passing through Sanborn and the Penn Central-Erie Lackawanna tracks near State Routes 265-384, are heavily used and would be the prime sources of railway noise.[18]

Future development, during the 1980-2030 period, will include the Lake Ontario State Parkway along Lake Ontario waterfront and the La Salle (Section 2) and Belt (Section 1) Expressways near the Canal's junction with the Niagara River.[18] These are expected to be heavily travelled. A third route paralleling the canal route from north to south would also create additional noise.[12] A jetport proposed for the Wheatfield or Lewiston area would increase the area exposed to high-level noise. The remainder of the canal route between Bergholtz and the proposed Lake Ontario State Parkway is now and will be expected to remain essentially rural with few sources of high level noise.

A second factor to be considered in determining the impact as a new sound source is added is the current use of the affected land. If the area is predominantly residential, or if the noise source is so loud that it intrudes on a residential area, the resulting change of the area is substantial if the noise is loud enough to interfere with normal activities of the occupants, change sleeping conditions, or to change the economic value of land in the area. On the other hand, areas which are predominantly commercial or industrial may tolerate an

additional noise source, especially if it does not increase the ambient level substantially. It should be noted that residential areas can tolerate a higher ambient level in the daytime than they can at night, and that commercial or industrial areas can tolerate a higher overall ambient level than one would expect to find in a residential area.

Several residential areas located within a mile of the proposed canal route are potentially noise sensitive. These include (1) the residential areas on the Lake Ontario waterfront, (2) the communities of Ransomville, Pekin, Sanborn, St. Johnsburg, and Bergholtz, and (3) a number of homes along Witmer Road near the Niagara River as well as along other roads passing near the canal route.

Urban growth by the late portion of the 1980-2030 period, expected to include the area south of Sanborn to the Niagara River as well as the Lake Ontario waterfront, will increase the residential area sensitive to noise.

E-27 Ecological Environment

Ecology may be defined as the study of the structure and function of nature. Nature is composed of two basic structural components: (1) the living organisms and (2) the nonliving environment in which these organisms live. Numerous functional interconnections among these structural components bind them together into a single entity – the ecosystem.

A healthy, stable, and productive ecosystem is one in which both the structural and functional aspects are in balance. The construction and operation of any project, if not properly planned and carried out, can affect this balance adversely and reduce the quality of the natural environment. Good planning can minimize the adverse effects and frequently improve the ecosystem quality.

In assessing the effects of the LE-LO Waterway properly, a methodical, comprehensive listing of important ecological components and indicators is used to organize the data to facilitate establishing the baseline ecological conditions.

Two components and thirteen indicators are used to assess the baseline ecological quality. The two components describing the ecological environment are Terrestrial Ecosystems and Aquatic Ecosystems.

E-28 Terrestrial Ecosystems

The terrestrial ecosystem includes all terrestrial populations. The characteristics of a community are different than just the simple sum of the characteristics of the component populations. The individual organisms of an ecosystem belong to an organized taxonomic hierarchy. A species is a group of individuals living and breeding together.

All the individuals of a particular species in a given locale constitute a population. A community includes all the living organisms found in a given locale or habitat.

Measuring all populations in an ecosystem would be an enormous task. Hence, the limited number of populations and groups of populations have been selected as indicators to reflect the health and quality of terrestrial ecosystems. The six indicators are: (1) natural vegetation, (2) crops, (3) dominant herbivores, (4) migratory species, (5) small game animals, and (6) rare and endangered species. These indicators are used to describe the system within the project area, a 1.1-mile-wide path to either side of the construction zone (varies from 2.4-2.8 miles in total width), and in adjacent areas.

E-29 Natural Vegetation

Natural vegetation is an important element of terrestrial ecosystems. Forests of all types and such areas as natural grasslands and old fields in all stages of succession are included within this indicator group. Areas within Niagara County and adjacent areas which are covered with natural vegetation provide most of the food for wild animals and some food for domestic grazers living in the area. Changes in natural vegetation that reduce the food supply available for wild and domestic animals may disturb the stability of an ecosystem. Such disturbance may hasten erosion or permit reduction of the fertility and production of the land, and/or accelerate the invasion of noxious weeds or other pest plants.

The natural vegetation of the Niagara Peninsula and the extended Lake Ontario shore area is more southern in composition than more inland areas at similar latitudes. Climatically controlled by the presence of the moderating effects of Lake Ontario and further magnified by local soil and other edaphic conditions, the region is of prime importance to fruit production (see E-30 for further description of environmental modifications).

The effect of the climatic conditions to the natural vegetation is, thus, twofold. The more southern nature of the climate has led to a tree species composition different from adjacent areas, exemplified by the greatly reduced importance of conifers coupled with extensive oak-hickory-elm forest.

Aside from the scattered small woodlots distributed rather evenly across the county, two areas with extensive natural vegetation cover remain. The Niagara Escarpment, which exhibits rocky slopes approaching the vertical in many areas, is not usable as farm or fruit-growing land and has been uncleared except for some small home lots and occasional road construction. Even these activities have been limited to the zones of lesser slope. The Tuscarora Indian Reservation contributes significantly to the available natural vegetation of the region. Approximately 59 percent of the reservation remains forested. Cultural characteristics of the Indians are thus manifested in differing agricultural and land-clearing practices.

Composition of the natural forest vegetation varies along the north-south axis of Niagara County. Due to microclimatic and edaphic variations north, south, and along the Escarpment, species composition and importance may vary from zone to zone. However, the species present vary little except as controlled by local groundwater conditions. The woodlots and forested areas of the County are characterized by a mixed hardwood composition of predominantly oak and hickory species. While varying locally in percent composition these species include white oak (Quercus alba), chestnut oak (Q. Prinus), swamp white oak (Q. bicolor), northern red oak (Q. rubra), and black oak (Q. Velutina), bitternut hickory (Carya cordiformis), pignut hickory (C. glabra), and shagbark hickory (C. ovata).

The swamp white oak is more important in the wetter areas south of the Escarpment while the northern red and black oaks are more abundant north of the Escarpment on the better drained lands. Other species of varying importance in the forested areas of the region which may be locally very abundant and even dominant include: beech (Fagus grandifolia), butternut (Juglans cinerea), black walnut (J. nigra), hop hornbeam (Ostrya virginiana), American hornbeam or blue beech (Carpinus caroliana), American elm (Ulmus americana), silver maple (Acer saccharinum), red maple (A. rubrum), and sugar maple (A. saccharum).

Stream banks and low-lying areas with high groundwater levels exhibit a different association of hardwoods. Along with the more-water-tolerant maple, elm, and hornbeams, other important species

include: cottonwood (Populus deltoides), willows (Salix sp.), and some birch (Betula sp.) and alder (Alnus sp.). These species are important to the natural ecosystems both for their role in erosion control with their affinity for watercourse edges and for production of wildlife food and cover.

Old field successional species and those classified as "weeds" are listed and discussed by Zenkert.[19] Much of the food and cover for small animals both game and nongame are produced in old field areas. Included are species of clover, sedges, asters, buttercups, grasses, and lespedezas.

The existing natural vegetation of Niagara County is presently concentrated within the Tuscarora Indian Reservation and in varying width bands along the face of the Niagara Escarpment. Numerous small woodlots are found throughout the area but cover less than 10 percent of the land. Urbanization patterns with attendant land-clearing operations are expected to continue in the immediate future. This will affect predominantly the area south of the Escarpment exclusive of the Indian Reservation and a narrow band along the Lake Ontario shore.

Agricultural acreage patterns are not expected to change greatly by 1980. Some land may be lost to urbanization south of the Escarpment, however.

By the year 2030, urbanization will have essentially eliminated natural vegetation outside of protected areas south of the Escarpment. Depending on economic pressures and population needs, the area along the Escarpment may be utilized for housing. North of the Escarpment, development will probably be concentrated along the Lake Ontario shore, effectively eliminating natural habitat from this area except for designated state or municipal parks. Thus, the trend in this area from 1980 to 2030 will be a gradual lessening of available acreage of natural vegetation.

E-30 Crops

The dominant land-use type along most of the proposed route of the canal is agricultural. As food chains and nutrient cycles are dependent on the kinds and extent of the various crops grown in the area, changes in the quantity and quality of agricultural crops result in a

modification of the existing environment. Row crops, pasture, tree farms, and orchards are included in the discussion.

In 1969, Niagara County had 171,937 acres in farm land. This constitutes 50.5 percent of the total land area in the county – significantly higher than the state which overall had 33.2 percent in farm production.[20] Fruit growing dominates the farm production in the county. Wheat, corn, vegetables, and hay and pasture are also important crops in the area.

Agricultural production within the region is controlled by two important environmental factors: soils and weather. Well-drained fertile soils such as the Alton or Dunkirk Series, which are prevalent north of the Escarpment, are ideally suited to orchard growth and production.[3] The influence of Lake Ontario coupled with the physiographic presence of the Escarpment produces a local climate equivalent to that of much more southern areas. Snowfall is greatly reduced over neighboring areas and, likewise, winter temperature extremes are moderated. Spring temperatures are depressed with the date of last frost delayed by as much as 2 weeks over neighboring areas. This phenomenon, slowing the flowering date of the fruit trees, protects them from a late killing frost. Likewise, the first frost of the fall season being delayed effectively increases the growing season in the fall. The day-to-day effect of the Lake on the climate follows the classic pattern of moderating temperatures in all seasons, thus providing protection to the fruit crops.

Table E-3 shows the production of fruit crops for Niagara County in the years 1964 and 1969.[20] It should be noted that production of both apples and grapes increased significantly during the period – a condition which is uncommon to agriculture within regions of increasing urbanization.

TABLE E-3. FRUIT PRODUCTION IN POUNDS FOR NIAGARA COUNTY, N. Y.[20]

	1964	1969
Apples	66,384,551	78,612,448
Peaches	6,562,921	4,133,780
Pears	7,519,167	6,586,058
Cherries	7,675,727	7,147,129
Plums and prunes	2,892,853	2,352,488
Grapes	6,874,969	8,624,087

Fruit production is not uniform throughout the county but is concentrated in specific zones. Grapes are produced in a zone parallel and north of the Escarpment to approximately Ransomville. Another band of intensive grape production is found just south of the Escarpment. Apples are grown throughout the area but production is concentrated along the shore of Lake Ontario and east of Ransomville.

A typical farm specializing in fruit within this region would utilize its acreage as follows: 60 percent apples, 20-25 percent cherries (higher if extremely well-drained soils), 10 percent peaches, 15-20 percent grapes, and 5 percent plums and prunes. A high percentage of new plantings, up to 20 percent for grapes and 10-15 percent apples, reported indicates a rapidly expanding production of these fruit types. A vineyard has a productive lifetime of approximately 50 years; an apple orchard, 20 to 25 years. Peaches, prunes, and plums are not being replaced probably due to more viable markets elsewhere in the county.(21)

Corn and wheat production in the county averages slightly below the state average. Corn productivity is 82 bushels per acre compared to a state average of 88 bushels per acre. Wheat production is 33.5 bushels per acre opposed to 38.5 bushels per acre over the state. Corn, both for grain and silage, occupied 15,616 acres in 1969; wheat 8,852 acres.(3)

E-31 Dominant Herbivores

The importance of this indicator lies in the fact that the large browsers and grazers which include cattle, horses, sheep, other livestock and the wild herbivores, such as deer, are the dominant animals of many ecosystems in North America. Consequently, any change in their numbers or in the ability of the land to support the population may result in a significant impact upon the health and stability of the environment. Also, as those dominant species are either domestic animals supplying food and other products of value to man, or are desirable game animals offering recreation and food, the importance of predicting their change is increased.

The only large browser currently in the project area (considered to be a path about 1.1 miles wide to either side of the construction zone - total pathway varies from 2.4 to 2.8 miles wide) is the white-tailed deer. The habitat preferences of the white-tailed deer include forestland, wooded wetlands, and somewhat open brushy areas.(22) The amounts of these types of habitats available in the

project area are tabulated fror the LUNR Land Use Overlays as follows[23]: forestland, 2045 acres; wooded wetlands, 5 acres; and brush cover, 3480 acres. This wild herbivore can do considerable damage to young orchards and certain vegetable crops if not controlled through hunting pressure or other wildlife-management practices. While data necessary to quantify the abundance of deer in the project area are lacking, generally speaking, deer are present in sufficient numbers to conflict with agricultural land use of the area (primarily orchards), and also, to present some problem with respect to road kill. During the hunting season, the wildlife management practices aim for a legal buck kill of 1 per square mile.[24] This further indicates a fairly high concentration of deer in the project area. Within the project area, the predominant grazers are cattle, sheep, and horses in that order. Recent agricultural data indicate that, within the state, Niagara County is not a particularly significant area for raising the grazers.[20] Of the 171,937 acres of farmland in the county, only 14,582 acres (approximately 8.5 percent) were reported to be used as pastureland. Some 23,000 cattle and calves, 3,900 sheep and lambs, and 1,100 horses were reported for Niagara County in 1969. This amounts to only 1 percent of the cattle, 4 percent of the sheep, and 2 percent of the horses raised in New York State. Most of these grazers are concentrated in an agricultural area to the south of the Escarpment, with very little livestock raising activity occurring on the lake plains to the north of the Escarpment.[25] Furthermore, both the amount of land used for grazing, and the number of livestock raised in Niagara County have declined only very slightly from that reported in 1964. With regard to the proposed route for the LE-LO Waterway, the LUNR Land Use Overlays indicate that only 194 acres are presently used for permanent pasture and grazing.[23]

From 1980-2030, an increase in the amount of urbanization is expected to occur in the general area south of the Escarpment, and along the Niagara River front and Lake Ontario shoreline. Since this urban spread will encroach upon existing woodland areas and land presently used for agricultural activities, a net reduction in habitat available to the browsing population can be anticipated. The slight decline in livestock-raising activities mentioned above can be expected to accelerate somewhat as both pasture land and crop land devoted to grain production for livestock consumption are preempted by this urbanization.

E-32 Migratory Species

The migratory species of interest consist wholly of the migratory birds that from time to time inhabit the area along the route of the canal. The significance of this group lies in the potential of any changes in these species or their numbers to affect areas far removed from the canal route.

Considered as a whole, the Niagara Frontier Region is presently an excellent birding area with some 372 different species noted as occurring in the area. Some of these species are essentially non-migratory, others are noted only during the summer months, some only during the winter, and still others are seen only during their migration through the area. A very general classification of the birds occurring in the region is given as follows(26):

Permanent residents	24
Introduced permanent residents	8
Summer residents	118
Summer visitants	3
Winter visitants	37
Transient visitants	114
Introduced rare transient visitants	1
Rare and very rare visitants	10
Casual and sporadic visitants	24
Accidental visitants	33
Total	372

As only about 9 percent of the area's bird species are permanent residents, it is apparent that a high proportion of the area's birds migrate through the region at various times of the year, at varying frequencies of occurrence, and in varying numbers.

While it is not possible to accurately determine exact numbers, locations, etc., the following excerpts from Birds of the Niagara Frontier Region point out some of the more significant birding areas, habitats, species, etc., to be found in relative proximity to the project area.(26)

> "Grand Island, in spite of the large number of new houses built in recent years, still possesses several types of good bird habitat. The open fields attract such species as American Golden Plover, Water Pipit and Horned Lark, as well as hawks and owls which prey on the many

field mice. Along the east branch of the Niagara River a thorn thicket provides good cover for land birds, and waterfowl are often observed near the shore.

Beaver Island State Park, at the south end of Grand Island, usually has a concentration of waterfowl off its shores in spring, fall and winter; they also come into Beaver Creek when it is not frozen over. Mud flats in the creek are often visited by herons, gulls, and shorebirds. The entire Niagara River shoreline area may at times teem with migrating birds.

Strawberry Island, lying in the Niagara River above Grand Island, is the center of concentration for thousands of waterfowl during the winter, both on its shoreline and in the surrounding waters. Usually Common Mergansers, Canvasbacks, Greater Scaups, and Common Goldeneyes are especially numerous, while swans and geese occasionally rest there during migration. Snowy Owls have been seen there on many occasions. The upper part of the river above Strawberry Island is an excellent area during migration for observation of Bonaparte's Gulls, Black Terns, an occasional Franklin's Gull or Little Gull, and other species of gulls and terns.

In the Tuscarora Indian Reservation many weedy fields with shrubby borders and a few woods and orchards attract sparrows and finches to this area at all seasons, while such brush-loving species as Brown Thrasher and Rufous-sided Towhee also occur there. Hawks and shrikes also seem to like this area, and for many years there has been a crow roost near the west border of the reservation.

Just below the Niagara Escarpment, near Pekin, lies Bond Lake, an old quarry now filled with water. Loons, grebes, geese and ducks are occasionally found there, particularly during the spring migration."

Seasonally, the bird life of the area is essentially static during January and February. A noticeable migration usually begins in March as some of the winter visitants leave for the North. During April and May, migration reaches its peak with the spring waterfowl flight, shorebird migration, and the arrival of the seed-eaters and insectivorus birds. Migratory waterfowl usage of the flyways in the area

include dabbling ducks, 31,000-100,000 birds; diving ducks, 76,000-250,000; and Canada geese, 25,000-75,000.[27] The maximum number of species is normally encountered from May 17-23 when it is possible to observe over 150 species in a single day. The month of June is the most active nesting period. During July, August, and September, the southward migrating shorebirds appear, reaching peak numbers in September. Also, by September the small insectivorous birds have departed for the south. During October and November, the seed-eaters leave and the winter visitants increase. In December, most of the birds in the area are either winter visitants or permanent residents.

Of particular significance during the 1980-2030 period, is the increase in urbanization expected to occur along the Niagara River front and along the Lake Ontario shoreline. These two important areas provide valuable habitats for the many waterfowl and shorebirds which inhabit the area during much of the year. From the data available, it is extremely difficult to establish any trend or patterns in the numbers and species inhabiting the area over a period of years in relation to the present level of urban development of the shoreline areas. Further complicating any assessment of change is the apparently normal fluctuation of both numbers and types of species over a period of years. Whether their present status is a temporary phenomenon or a permanent change resulting from an environmental alteration is a matter of conjecture. Generally speaking, a reduction in available habitat, such as brought about by increased urbanization and associated human activity, will lead either to a redistribution throughout the remaining territory or to a reduction in numbers of species. Also an increase is possible in the abundance of those species more adapted to existence in an urbanized environment.

E-33 Small Game Animals

Included in this indicator are the small game mammals and upland game birds of which rabbits and pheasants are the most significant in the project area. The importance of this group stems from the fact that it occupies an intermediate position in the food web and any significant changes in absolute or relative numbers resulting from the canal project would signal a shift in the stability of the natural ecosystem.

While exact figures are not available regarding the abundance of this huntable resource, rabbits and, in particular, pheasants are reported to be abundant.[28] Reinforcing this is the availability of ideal

habitats of brushy, forested areas for the rabbits, and open fields and cornfields bordered by hedgerows for the pheasants. These habitats are conducive to supporting high populations of pheasants and rabbits. In particular, the project area is reported to be a prime pheasant range, yielding a harvest rate higher than that for the rest of the state.[24] Even though the demands for hunting are high, the area affords limited hunting opportunities due to posting of farms and the amount of industrial development occurring along the Niagara River.

The increasing urbanization anticipated between 1980 and 2030 for this area will no doubt preempt certain agricultural lands, woodlands, hedgerows, etc., presently utilized as habitats by these small game animals. The extent of this encroachment and the resulting change in the abundance of these small game animals will depend in large measure upon the agricultural reaction to the situation. For instance, if offsetting amounts of idle crop land or land lying fallow is opened up for farming, adverse changes in this instance would be a redistribution of these small game animals throughout the territory.

E-34 Rare and Endangered Species

Species which are uncommon, rare, or endangered are particularly sensitive to change in the quality of the environment. Included within this parameter are those species officially listed as rare or endangered in the United States[29] as well as those species which are endemic to New York or endemic to the United States. State endemic species are those found only in a single area within the state, even though they may be found in other states. They may be common where they are found.

The value of interpreting the status of rare or endangered species within the project area lies in the potential for the Waterway to directly (by actually destroying an organism) or indirectly (by habitat destruction or alteration) cause a decline to one or more of any rare or endangered populations. The presence of rare and endangered species within the project area or a decrease in the number of existing individuals with a known rare or endangered population would constitute a project related decrease in environmental quality.

Six species officially listed as rare or endangered have ranges that cover the area of Niagara County though only two of these species would be expected to be seen in the area.[26, 29, 30]

The Southern Bald Eagle, Haliaeetus leucocephalus leucocephalus (endangered), is known to have been reasonably abundant and to have nested successfully along the Niagara River, especially near Goat and Grand Islands before the turn of the century and more recently (1940's) on Navy Island. However, bridges to these islands and residential development along the river displaced these populations. Occasional sightings of this species are reported but no active nesting sites are now known from Niagara County.(26)

The American Peregrine Falcon, Falco peregrinus anatum (endangered), is infrequently seen in the area of the Lake Erie and Lake Ontario shores during their migration through the region. Beadslee and Mitchell(26) define these periods as March 15 to May 20 and September 6 to October 15, with the greater number being cited in the fall period. The number of sightings of this falcon in Niagara County has been drastically reduced within the last two decades reflecting the serious overall decline in this species.

Two mammal species, both endangered, have ranges in this area though it is highly unlikely that either occurs within Niagara County, New York. The Indiana Bat, Myotis sodalis, is associated with limestone caves throughout the midwest and eastern United States. Since no limestone caves occur along the route of the canal, this species should not be encountered. The Eastern Timber Wolf, Canis lupus lycaon, did range freely over this region of New York as it did over most of the eastern United States. However, it is now believed to be nearly, if not totally, extinct within the borders of the United States except for limited populations in northern Minnesota and Michigan. The last authenticated record of the wolf in New York is 1899, although a sighting is recorded in Fulton County in 1968.(29)

The Greater Sandhill Crane, Grus canadensis tabida, is classified as rare. The range for this species is reported to include infrequent breeding in southwestern Ontario. It is known as an "accidental visitant" to the Niagara Frontier Region though none have been reported in this century.(26)

Another rare species, the Bog Turtle (Clemmys muhlenbergi) is reported in a broken range from Connecticut to southwestern North Carolina.(29) Conant gives the habitat for this species as swamps, sphagnum bogs, and slow-flowing streams. Such habitats occur within Niagara County and along the Waterway route but Conant does not include this area in the range.(30)

No endemic species have been identified within the region either south of the Escarpment, along the Escarpment, or north of it along the Lake Ontario shore. The lack of identification of any species does not preclude their existence, though none would be anticipated within the agriculture areas north or south of the Escarpment. The flora of the Niagara Escarpment has not been exhaustively studied and the presence of such a species cannot be ruled out, even though it is highly unlikely that it would not have been identified at this time.

Projection of the future for rare and endangered species is difficult. Political pressures to encourage protection may greatly benefit a species, or natural disaster may eliminate a drastically reduced population. However, alteration of habitat and loss of isolation from man is the main force behind the reduction in numbers of these species discussed above. Inasmuch as the human population of Niagara County is expected to continue growing, these negative influences will continue and will increase. Since no viable populations of any of these species exists within the region, none would be anticipated in the future, and in fact, reductions in the number of sightings of these species is anticipated.

E-35 Aquatic Ecosystems

The aquatic environment, for purposes of environmental impact evaluation of the proposed LE-LO Waterway, comprises the following six indicators: (1) vegetation, (2) zooplankton, (3) benthos, (4) fishes, (5) pest species, and (6) rare and endangered species. The aquatic ecosystems discussed here are the upper Niagara River, including the Niagara River East which passes around Grand Island, and the inshore area of Lake Ontario between the mouth of the Niagara River and Olcott, New York. An evaluation of each indicator provided a baseline for predicting future trends and status of each indicator. Impacts were evaluated in the context of projected baseline conditions.

E-36 Vegetation

Vegetation consists of those organisms that perform roles as primary producers. These can be further categorized as phytoplankton, certain periphyton members, and vascular aquatic plants.

Phytoplankton. These are pelagic organisms, usually unicellular, and at the mercy of winds and currents. They represent food

sources within lentic aquatic ecosystems. Phytoplankton populations occurring in the upper Niagara River, in order of abundance, are diatoms, green algae, and blue-green algae.[31] These organisms are transients originating in eastern Lake Erie, and indicate according to respective dominance, the absence of gross nutrient enrichment in these waters. Green algae and diatoms dominate the phytoplankton communities of Lake Ontario.[32] Species representing the blue-green phytoplankton group are present. Regions of major nutrient input to Lake Ontario, such as the inshore strip surrounding the lake and the confluence of Welland Canal and Niagara River waters with lake waters, are found to support greater biomasses of planktonic algae than are found in open lake waters.

Periphyton. Attached organisms (both plant and animal) growing on the bottom or on other immersed substrates in a waterway are designated collectively as "periphyton". Certain members of the periphyton group, such as filamentous algae, function as primary producers within the ecosystem. The most important representative in both aquatic systems (upper Niagara River and Lake Ontario) is the filamentous algae, Cladophora glomerata. Cladophora grows quite prolifically along the southern shore zone of Lake Ontario and commonly results in nuisance accumulations on beaches in that vicinity.[33] Cladophora is also found in the Niagara River but does not produce a large standing crop.

Vascular Aquatic Plants. These are multicellular organisms which include rooted submergent, rooted emergent, and floating forms. Such plants are important components of many aquatic ecosystems because they serve as food, shelter, and substrate for a variety of other organisms. The upper Niagara River area supports a considerable diversity of aquatic macrophytes, over 30 species ranging from water milfoil and cattail to burr-reed and willows.[19] These plants are found along the river banks and edges of Grand, Strawberry, Buckhorn, and Navy Islands. The shore-zone region of Lake Ontario between the Niagara River and Olcott, New York, constitutes habitat largely unsuitable for production of aquatic vascular plants. This results from the coarse bottom material (cobbles and rocks) which is not conducive to the establishment of vascular plant roots. Hence the indicator is not applicable here.

Although the perimeter areas of Lake Ontario are undergoing eutrophication, the open waters of the lake are judged mesotrophic.[34] Provided contemplated projects intended to curtail nutrient input to

Lakes Erie and Ontario are implemented, vegetation indicators as described above will remain fairly constant during the 1980-2030 period, i.e., some species turnover will occur but major shifts in group dominance are not expected.

E-37 Zooplankton

This group consists of the animals of the plankton. These are unattached organisms having minimal capability for locomotion. They are important constituents of standing-water aquatic ecosystems. The typically herbivorous food habits of zooplankton provide an essential link between primary producers and higher carnivores such as game fishes. Zooplankton common to the upper Niagara River, in order of abundance are rotifers - primarily Keratella, Polyarthra, and Branchionus; copepods - primarily Diaptomus and Cyclops; and the cladocerans - Daphnia and Bosmina.(35) These genera are quite common to eastern Lake Erie, and many have been found in water samples obtained from the City of Buffalo water supply intake. These organisms are presumed to move passively from the lake into and through the Niagara River. Studies on zooplankton composition in both inshore and offshore areas of Lake Ontario revealed an abundance of copepods and cladocerans.(36) Most prevalent genera were Cyclops and Bosmina. Common rotifer genera in Lake Ontario are Asplanchna and Keratella.(37)

Species turnover of zooplankters in Lake Erie, and possibly in Lake Ontario, has occurred without altering the dominant zooplankton genera.(37) Therefore, it is anticipated that although minor shifts in zooplankton occurrence and abundance might occur during the 1980-2030 period, the principal representatives mentioned above will remain.

E-38 Benthos

This indicator includes those organisms that exist for a substantial portion of their life cycle attached to or living within bottom sediments, e.g., mollusks, insect larva, and oligochaete worms. These forms are important in food webs and are generally the most sensitive indicators of stress in response to point source effluent discharges. Spatially, benthos populations in the upper Niagara River range from nearshore pollution-tolerant populations dominated by oligochaetes to diverse midriver pollution-intolerant communities consisting of assorted aquatic insect larva, crustaceans, and mollusks.(38) For

eutrophic inshore waters of Lake Ontario, the most common macrobenthic organisms are oligochaete tubificids.[39] Crustacean amphipods and isopods occur abundantly at inshore areas along with many dipteran larva.

Pollution-tolerant benthic populations inhabiting certain nearshore areas along the banks of the upper Niagara River are expected to decrease in the period from 1980 to 2030 as measures are implemented to control industrial and domestic pollution. Benthic assemblages are expected to remain as a diverse community characteristic of unpolluted waters.

Lake Ontario is unique in that a rim of comparatively degraded water surrounds its perimeter. If water quality in nearshore areas can be improved to match that of open lake waters, then benthic communities should shift from a predominance of sludge worms to the promotion of more pollution-intolerant populations.

E-39 Fishes

This indicator includes both rough and game fishes, large and small. Fishes are important ecologically in that nearly all forms occupy significant positions insofar as food relationships within a food web are concerned. A well-established community, consisting of both forage and predator species exists in the upper Niagara River. Sport fishing for perch, blackbass, pike, and muskellunge is popular. Strawberry Island, located above Grand Island in the upper Niagara River, is reported to be a spawning area for large- and small-mouth blackbass and a popular fishing site.[40] Fish populations in Lake Ontario are predominantly warm-water omnivores, and alewives providing a sound forage base throughout the lake. Other colonists, white perch and smelt, are abundant. The stocks of commercially valued piscivores, Atlantic salmon, lake trout, deepwater ciscoes, and white fish have disappeared or declined seriously in abundance.[41]

The Lake Ontario fishery resources have undergone severe degradation during this century. Species succession has progressed from an earlier predominance of cold-water species to a present predominance of warm-water, inshore species. The trend in future years (1980-2030) is expected to be increased standing crops of warm-water species whose tolerance to environmental perturbation provides an advantage over other species. The upper Niagara River continues to support a well-balanced predator-prey community in spite of industrial encroachment along the shoreline. Since current forecasts do

not predict degradation of water quality in eastern Lake Erie, continued maintenance of the fish community in the Niagara River is expected. With continued stocking, salmonid populations might become established in these aquatic ecosystems in future years.

E-40 Pest Species

Pest species include those organisms whose presence in an ecosystem pose a direct or indirect adverse effect upon baseline ("normal") ecosystem processes. Due to unusual increases in number or elaboration of biomass, some organisms naturally occurring in aquatic ecosystems become pest species. Others represent misplacement of exotic species, often due to human activities, e.g., the gypsy moth in New England and the lamprey in the Great Lakes. No species are recognized as pest in the upper Niagara River. In Lake Ontario, the filamentous alga, Cladophora glomerata, and the sea lamprey, Petromyzon marinus, are judged to be pests.

As future pollution-abatement projects become realities, Cladophora production along the south shore of Lake Ontario should decrease thereby eliminating large accumulations of dead and decaying algae on beaches. Lampreys will continue to be a pest species to an undeterminable extent in Lake Ontario. Whether lamprey populations can be controlled at present low levels in the event that salmonids "fill" the large-piscivore niche in the lake is unknown.

E-41 Rare and Endangered Species

Rare species are those which are not typically found or are found in very low abundance during conventional sampling and/or observational procedures. This may be due to the fact that these forms play a very minor role day to day in the ecosystem processes, or their numerical abundance is not necessary for essential roles to be performed. Often, a "rare" species in one ecosystem is much more abundant in other ecosystems and may represent one of a variety of geographical range extensions. These forms are significant to the naturalist and basic research-oriented biologist. Endangered species may or may not be numerically abundant at any one time within an ecosystem. Their endangered status is usually defined according to some environmental perturbation instigated directly or indirectly by human activities. No generalizations can be made regarding the ecological importance of endangered species without knowledge and interpretation of a substantial amount of information pertaining to the ecosystem in

question. However, many endangered species enjoy substantial importance in the eyes of the concerned public. Blue pike, Stizostedion V. glaucum, might be considered in this category for the upper Niagara River. However, this species is a questionable entry due to lack of documented occurrence in the area in recent time and moreover, the subspecies may already be extinct.(42) In Lake Ontario, specimens of the coregonines, burbot, white bass, and lake sturgeon are occasionally still caught. Lake whitefish and walleye stocks have drastically declined and are considered endangered.(41)

A resurgence of any of these species is unlikely during the 1980-2030 period; presumably, most will become extinct in the area.

HUMAN ENVIRONMENT

E-42 Introduction

The human environment may be defined as including those elements of the environment that have a major influence in determining life-style, culture, and individual or community well-being.

Specifically, it can be disaggregated into two broad analytical components (1) socioeconomic determinants including regional economic and social considerations, and (2) aesthetic, recreational, and cultural determinants.

A stable and healthy human environment embodies a dynamic evolutionary balance between development and change, and preservation and pattern maintenance. As in the ecological environment, the development and operation of any project, especially one of the magnitude of the proposed LE-LO Waterway, can have a devastating effect upon this balance, and severely reduce the quality of life. Sound and thoughtful planning, however, taking into consideration the variety of local and regional needs and sensitivities, can minimize the adverse effects. Appropriately undertaken, it can result in an overall improvement in existing human environment quality.

To fully evaluate the effects of the proposed Waterway, a comprehensive listing of essential socioeconomic and recreational/cultural components and surrogate indicators is needed. This list can then be used to organize and define the baseline human environment conditions. This baseline is essential in comparing the impacts of possible alternative futures.

These two basic categories are broken down into six components and nineteen indicators in this analysis to define the baseline human environments.

E-43 Socioeconomic Environment

E-44 Regional Economics

The purpose of this section is to develop a baseline description of present economic conditions of the human environment in the project area and to project socioeconomic conditions for the area in the year 2030 without the project. This section is intended to complement the

other sections describing and analyzing the human environment. Since all major construction projects have certain impacts on social and economic characteristics of local areas, it is important that these characteristics be defined carefully and ongoing trends in the composition of socioeconomic characteristics of the area be described. Regional economic characteristics include such things as employment, transportation, income levels, distribution of income, availability of public services, and the general economic conditions and opportunities for residents of the project area. Through establishing baseline descriptions of these characteristics, it is possible to measure the potential effects of the project for disruption of the community, both beneficially and adversely. Important items for which baseline conditions must be established and for which alterations and changes due to the project are to be measured include

- Additions to community employment during construction and operation of the project
- Increased demand for community services (education, health, police and fire protection, and other social welfare services)
- Demands on housing in the project area
- Transitional disruptions in transportation patterns during construction and operation due to the project
- Increased demands for other public services such as schools.

After establishing a baseline of present and projected conditions, it is then possible to discuss alternatives to the project and to evaluate them in terms of their expected impact on important community characteristics. In developing the baseline, the region for which the project is expected to have impacts must be defined. For this section of the report, the impact region has been divided into two overlapping areas. First, the area of immediate Waterway impact includes the communities directly along its route or those that are expected to be disrupted during construction and operation as a result of realignment of major east-west transportation routes. These communities include North Tonawanda on the southern extremity of the Waterway portion of the project, Bergholtz, Sanborn, Pekin, and Ransomville. The secondary region includes all of Niagara County including the major cities of Lockport and Niagara Falls, and to a certain extent the western New York and Niagara Frontier region of Erie-Niagara Counties and the Canadian portion of the Niagara Peninsula.

The second region is defined primarily by the commuting radius to the project as well as the general economic base region of the Buffalo-Niagara Falls area. Since much of the data available for the region are provided on a county basis, it is not always possible in conducting the socioeconomic baseline projection to locate adequate disaggregated data. Population projections exist on a community basis, but projections of labor force profiles and industrial base for the region were not obtained during the course of the study. Certain trends can be identified in terms of employment and industrial base for a specific community, such as Niagara Falls or Buffalo, but extrapolation of these beyond more than a decade is largely speculative.

Five essential economic indicators have been identified as important for evaluating the effects on the socioeconomic environment from project implementation and operation. These five indicators include (1) employment base in terms of the industrial and economic composition of the two regions, (2) population growth characteristics, (3) income levels and distribution of income, (4) unemployment rate, and (5) public services including transportation facilities. Baseline descriptions and projections for each of these major indicators are presented below. No attempt was made to develop primary projection data, but best available secondary projections were used. Although there are some differences in projection dates, these data provide useful baseline information.

E-45 Employment Base

The nature of the employment base for the communities to be affected by the Waterway as well as the secondary region provides a significant indication of two important factors. First, it indicates the general economic health of the region, both present and projected, in terms of the relationship of construction and operation of the Waterway as an additional short-term increase in employment. Second, it shows the extent to which labor demands for construction and operation can be met in part by local labor supplies. These labor supplies may be in industries that are either phasing out or in construction sectors of the local economy where employment opportunities during the construction period may be insufficient to maintain a full employment rate. The basic importance of establishing the employment base and projecting it is a key factor in developing projections for most of the other significant socioeconomic indicators.

Present Employment Base. General 1970 employment base by sector is available for the Buffalo Standard Metropolitan Statistical Area (SMSA)[43]. Since local workers on the project will be drawn from within commuting radius of the project, the Buffalo SMSA is the

most appropriate regional classification. Source of actual employment on the project will depend on the individual contractors and other major national projects phased out at the time the canal project is under way. Although the project site is located near the Canadian border, it is very likely that labor union restrictions and international balance of payments considerations will result in strict limitations on the numbers of workers entering from the Canadian side of the border. Percent of personal income from employment by sectors for Niagara and Erie Counties is shown in Table E-4 below.[43] Personal income* is used as the significant indicator of the relative importance of the various components of the employment base. Total personal income for Erie County in 1970 was $3,162,200,000 and for Niagara County $645,000,000. As the above statistics indicate, Niagara County in particular is heavily dependent on manufacturing as a source of employment and income. Table E-5 presents the occupational categories for Erie and Niagara Counties.[44]

TABLE E-4. PERCENT OF PERSONAL INCOME FROM WAGES AND SALARIES IN 1970[43]

Sector	Area			
	Erie	Niagara	Buffalo SMSA (Erie and Niagara Counties)	State of New York
Farms	0.09	0.3	0.1	0.1
Contract construction	5.6	5.0	5.5	4.9
Manufacturing	36.0	58.1	40.2	26.2
Wholesale and retail trade	16.0	8.9	14.7	17.0
Finance, insurance, and real estate	4.0	1.4	3.5	8.7
Transportation	6.0	1.8	5.4	5.3
Communication and public utilities	3.2	1.4	2.9	3.5
Services	10.6	7.7	10.1	16.4
Government	17.7	15.2	17.3	17.6
Other	0.3	0.2	0.3	0.3

*Personal income, as defined by the U.S. Department of Commerce, is the amount of current income received by persons from all sources, including government and business transfer payments, but excluding transfer payments from other sources. Personal income also includes estimates of nonmonetary income such as value of food consumed on farms and the estimated rental value of owner-occupied homes.

TABLE E-5. OCCUPATIONAL CATEGORIES FOR NIAGARA AND ERIE COUNTIES[44]

Occupation	County			
	Erie		Niagara	
	Numbers	Percent	Numbers	Percent
Total employed, 16 years old and over	422,179		97,610	
Professional, technical, and kindred workers	64,530	15.3	11,441	13.1
Engineers	6,739	1.6	1,411	1.6
Physicians, dentists, and related practioners	3,808	0.9	409	0.5
Health workers, except practioners	7,956	1.9	1,453	1.7
Teachers, elementary and secondary schools	15,211	3.6	2,943	3.4
Technicians, except health	5,145	1.2	1,339	1.5
Other professional workers	25,671	6.1	3,886	4.4
Managers and administrators, except farm	30,126	7.1	5,655	6.5
Salaried: Manufacturing	5,329	1.3	1,251	1.4
Retail trade	6,343	1.5	1,060	1.2
Other industries	14,433	3.4	2,287	2.6
Self-employed: Retail trade	2,351	0.6	630	0.7
Other industries	1,670	0.4	427	0.5
Sales workers	33,912	8.0	5,466	6.2
Retail trade	20,490	4.9	3,621	4.1
Other than retail trade	13,422	3.2	1,845	2.1
Clerical and kindred workers	76,430	18.1	13,648	15.6
Craftsmen, foremen, and kindred workers	64,587	15.3	14,191	16.2
Automobile mechanics, including body repairmen	4,957	1.2	1,201	1.4
Mechanics and repairmen, except automobile	8,858	2.1	2,259	2.6
Metal craftsmen, except mechanics	10,271	2.4	2,069	2.4
Construction craftsmen	12,529	3.0	3,248	3.7
Other craftsmen	27,972	6.6	5,414	6.2
Operatives, except transport	61,065	14.5	17,162	19.6
Durable goods manufacturing	34,461	8.6	9,852	11.2
Nondurable goods manufacturing	12,240	2.9	5,326	6.1
Nonmanufacturing industries	12,364	2.9	1,984	2.3
Transport equipment operatives	15,993	3.8	3,415	3.9
Laborers, except farm	19,075	3.4	4,080	4.7
Construction laborers	2,255	0.5	451	0.5
Freight, stock and material handlers	9,234	2.2	1,875	2.1
Other laborers, except farm	7,586	1.8	1,754	2.0
Farmers and farm managers	1,142	0.3	661	0.8
Farm laborers and farm foremen	970	0.2	550	0.6
Service workers, except private household	51,290	12.1	10,864	12.4
Cleaning service workers	12,048	2.9	2,649	3.0
Food service workers	16,326	3.9	3,497	4.0
Health service workers	7,614	1.8	1,470	1.7
Personal service workers	5,727	1.4	1,310	1.5
Protective service workers	6,301	1.5	1,333	1.5
Private household workers	3,059	0.7	477	0.5

In terms of trends in the regional economy, the Buffalo SMSA saw a decline in nonagricultural wage and salary employment between 1960 and 1961 of 18,700 workers.[45] Overall regional employment expanded at a slow rate from 1961 to 1965, but has grown more rapidly at an annual rate of 9,000 to 10,000 jobs (approximately 2 percent) since 1966.

Another major factor in the downturn in the regional economy, particularly the Niagara Falls area, was the destruction of the Schoellkopf Power Plant by a rockslide in 1956. Although the area had already begun to experience a general industrial decline, the power plant destruction accelerated this trend. For example, in the 1950 manufacturing sector approximately 27,000 workers were employed. By 1970 this was down to approximately 20,000.[46] Three major factors are considered responsible for this general decline in manufacturing in the Niagara Falls area. First, the competitive advantage of the area had in terms of abundant low-cost power had been offset in recent years by the declining costs of power production from fossil fuel and nuclear sources. Improvements in transmission technology have also freed manufacturing locations from proximity to hydroelectric power sources. Second, modernization of local firms has tended to occur in areas where lower costs prevail both for labor and construction. Third, after the destruction of the Schoellkopf Power Plant, there was a substantial reduction in power for the area until the Robert Moses Power Plant was available in 1962. The shortage forced some employers to seek other locations where adequate and inexpensive power supplies were available. Technological factors involving converting old 25-cycle plants to 60 cycles also induced firms to seek new locations or to cut back production locally.[47]

Employment base breakdowns for individual communities located in proximity to the Waterway, discussed briefly in the following section, are based on summary statistics from the 1970 Census of Population.[44] These communities include North Tonawanda and Lockport. For Lockport, in 1970, 45.9 percent of the work force was employed in manufacturing establishments, 42.7 percent in white collar occupations, and 15.3 percent in government categories. In North Tonawanda, 48 percent were employed in manufacturing, 42 percent in white collar occupations and approximately 11 percent in government.

Projected Employment Base. To describe the effects of construction and operation of the Waterway on the regional economy during the construction period and after completion, it is essential to provide an indication of the composition and nature of the economy at that point in time. Projection of regional economic variables beyond a few years is

hazardous because of the large number of unpredictable factors such as single industrial locations, transportation, and routing and technological changes that result in altering locational advantages for specific regions. Most of the comprehensive projections available for the general standard metropolitan statistical area were conducted for the Erie and Niagara Regional County Planning Board, and project economic and demographic variables from 1966-67 to the year 1990 (Table E-6).[48] Since projections for the years 1980 and 2030 are required, this information must be abstracted from the Erie and Niagara Reports. Other economic and demographic projections indicate a lower level of development in certain sectors of the economy than is provided by the Erie and Niagara Report. In this report possible upper and lower ranges are specified and the assumptions underlining the projections are identified.

E-46 Population Growth

Present and projected population estimates for the Niagara and Erie County area are based on population projections from the New York State Office of Planning Services: Demographic Projections.[49] The population is listed both for the counties and the individual communities within Niagara County that will be subject to the immediate impacts from construction and operation of the Waterway. Since future population of a region is dependent upon many interacting factors, including the availability of services, the trend in the employment (including several unknowns such as changes in technology factors creating specific regional advantages), as well as the overall national birth rate as it relates to the region, projections are at best a tenuous method for indicating future patterns of development and demands on services for the specific project region. Where the available population projections appear to be overly optimistic based on certain ongoing trends in the Buffalo SMSA, such adjustments are noted. An important use of population projections is to provide a base against which any temporary, construction-dependent increment of employment to the region can be compared. Using this form of analysis, the base projections themselves lose significance in terms of the possible range of error associated with such projections. Table E-7 below presents current population and projected population for selected years for both Niagara and Erie Counties, and for selected communities within Niagara County.[43,49]

TABLE E-6. THE BUFFALO SMSA – PROJECTED EMPLOYMENT IN MAJOR ECONOMIC SECTORS IN ERIE AND NIAGARA COUNTIES (48)

(Thousands)

	1970	1975	1980	1985	1990
Total jobs	548.0	593.5	642.8	674.5	703.0
Erie County	457.4	497.7	539.7	568.2	593.7
Niagara County	90.6	95.8	103.1	106.3	109.3
Self-employed, agriculture and domestic workers	55.0	53.0	51.0	49.0	47.0
Erie County	44.9	43.2	41.6	40.0	38.4
Niagara County	10.1	9.8	9.4	9.0	8.6
Nonfarm wage and salary worker	493.0	540.5	591.8	625.5	656.0
Erie County	412.5	454.5	498.1	528.2	555.3
Niagara County	80.5	86.0	93.7	97.3	100.7
Manufacturing	182.0	185.3	188.9	192.2	194.6
Erie County	140.5	142.5	145.3	148.3	150.0
Niagara County	41.5	42.8	43.6	43.9	44.6
Nonmanufacturing	311.1	355.2	402.9	433.3	461.4
Erie County	272.3	311.7	352.4	379.8	404.8
Niagara County	38.8	43.5	50.5	53.5	56.6
Contract construction	22.2	25.8	29.3	31.9	33.7
Erie County	18.7	21.9	24.7	26.8	28.4
Niagara County	3.5	3.9	4.6	5.1	5.3
Transportation and public utilities	32.0	32.6	34.2	35.6	37.3
Erie County	28.1	28.6	30.0	31.3	32.8
Niagara County	3.9	4.0	4.2	4.3	4.5
Fin.; insurance, real estate	17.6	19.4	21.2	22.0	22.8
Erie County	15.9	17.5	19.3	20.0	20.8
Niagara County	1.7	1.9	1.9	2.0	2.0
Wholesale and retail trade	96.7	109.5	123.4	132.3	140.4
Erie County	84.7	96.5	108.2	115.9	123.1
Niagara County	12.0	13.0	15.2	16.4	17.3
Services and misc.	70.0	83.0	98.0	109.4	120.0
Erie County	64.3	76.2	89.6	100.4	110.1
Niagara County	5.7	6.8	8.4	9.0	9.9
Government	72.5	84.8	96.4	102.0	107.1
Erie County	60.6	70.9	80.6	85.2	89.6
Niagara County	11.9	13.9	15.8	16.8	17.5

TABLE E-7. PRESENT AND PROJECTED POPULATION FOR ERIE AND NIAGARA COUNTIES, SELECTED COMMUNITIES, AND TOWNSHIPS, 1970-2030[43,49]

(Thousands)

	1970	1980	2000	2030
Erie County - Total	1,133	1,164	1,283	1,446
Buffalo	463	408	365	365
Niagara County - Total	236	243	255	259
Lockport	25	28	33	44
Niagara Falls	86	77	73	73
North Tonawanda	36	38	46	58
Lewiston (township)	13	18	24	37
Porter (township)	5	8	10	13
Wheatfield (township)	10	10	11	15

As can be seen, declines are expected in both the Niagara Falls and Buffalo central cities. This phenomenon is fairly typical of large northeastern central cities and is expected to have the same implications for the areas surrounding Niagara Falls and Buffalo. Specifically, growth is expected to occur in suburban and outlying areas as middle and upper income families continue to leave the central city area over the planning period. This will result in increased demands for housing and public services in the immediate area surrounding Niagara Falls and Buffalo. These spatial demographic changes in location can be attributed in part to the erosion of the regional industrial base. Although new industry is expected to locate in the area, the mature industries that have been the mainstay of the area economy for several decades will continue to locate new facilities and expand in other areas where labor and other costs are more attractive. The data indicate, even for those areas expected to grow, annual growth rates generally below the national average, which is about 1.3 percent for the 1960–1970 period.[50] Erie County population is projected to grow at an annual rate of 0.5 percent from 1970 to the year 2000. That for Niagara County, on the other hand, is expected to increase at about 1 percent annually between 1970 and 2000. From 2000 to 2030, incremental growth rates show a much lower rate of expansion for all communities as indicated by the demographic projection data.

E-47 Income Levels and Distribution

Although not necessarily meaningful in themselves, estimates of family and per capita annual income serve as an important indicator of the relative well-being of a region. This information coupled with distribution of income provides a reasonable indication of the ability of residents in the area to purchase basic necessities as well as to acquire health, educational, and recreational services. Present income levels for Niagara and Erie Counties and selected communities within these two counties are presented in Tables E-8 and E-9.[43,44,51]

TABLE E-8. PER CAPITA INCOME BY COUNTY OF RESIDENCE[43]

	1960	1970	Percent Growth
Erie County	$2,356	$4,080	5.6
Niagara County	2,193	3,642	5.2
New York State	2,807	4,771	5.4

TABLE E-9. INCOME AND INCOME DISTRIBUTION FOR SELECTED COMMUNITIES IN THE PROJECT AREA, 1960 AND 1970[44,51]

			Percent With Family Incomes			
	Median Family Income		≤$3,000	Below Poverty Level*	≥$10,000	≥$15,000
Area	1960	1970	1960	1970	1960	1970
Niagara County	$6,692	$10,203	10.9	6.1	18.1	19.3
Lockport	6,584	10,617	11.1	5.0	20.1	22.9
Niagara Falls	6,630	9,498	12.0	8.4	17.4	15.1
North Tonawanda	6,554	10,410	9.3	5.2	14.9	18.0
Erie County	6,395	10,482	12.6	6.9	17.3	21.9
Buffalo SMSA	6,455	10,430	12.2	6.8	17.4	21.4
Buffalo	5,713	8,804	17.3	11.2	13.1	14.1
New York State	6,371	10,617	13.8	8.5	19.9	26.5

*Poverty level is based on a definition originated by the Social Security Administration in 1964 and subsequently modified by a Federal Interagency Committee. The index provides a range of poverty income cutoffs adjusted by such factors as family size, sex of the family head, number of children under 18 years old and farm and nonfarm residence.[44]

Table E-8 shows that both Erie and Niagara Counties have a lower per capita income basis than the rest of the State of New York. Similarly, Niagara County has not experienced the rapid growth in money income per capita as has Erie County or the State itself. From Table E-9 other interesting observations and comparisons can be made. Whereas in 1960 median family income in both Erie County and Niagara County was above that of New York State itself, in 1970 the median family income in the two counties was below the state average. In Erie County, Buffalo shows a significantly lower median family income and a larger percentage of its population below the poverty level compared to tne over all New York State statistics. Similarly, the proportions of area residents above the $10,000 level in 1960 and the $15,000 level in 1970 are lower than the state average. Smaller communities in the area for which data were available from the 1970 census show that, relatively speaking, their proportion of families below the poverty level is lower and also that of families earning more than $15,000 is greater.[44] While these figures are necessarily highly aggregated, they provide significant indication of the general economic status of the residents of the project region. Unfortunately, more detailed estimates of income distribution or income levels for communities along the proposed Waterway are not available. Other than to protect the present per capita income growth rate based on national growth in GNP, it is not possible to be specific or provide meaningful insights by extrapolating regional increases over the 1980-2030 period. No attempt is made to project these variables, particularly since the major effect of the project is in terms of impact of unemployment rate and disruption of community services during and immediately after project construction.

E-48 Unemployment Rate

A significant indicator of the beneficial effects that the project may have on a short term is the regional and community unemployment rates. Table E-10 shows unemployment rates in 1960 and 1970 for selected communities.[44,51] No attempt is made to project these unemployment rates over the project period other than to assume that they will remain similar to the 1960-1970 rates. Unemployment projections require sophisticated methodologies and quantities of data that are not available within the scope of this project report.

TABLE E-10. UNEMPLOYMENT FOR SELECTED COMMUNITIES IN THE ERIE AND NIAGARA COUNTIES REGION, 1960 AND 1970[44, 51]

	Percent Unemployment	
	1960	1970
Erie County – Average	6.7	4.7
Buffalo SMSA	6.6	4.8
Buffalo	8.5	6.0
Niagara County – Average	6.5	5.4
Lockport	6.6	4.5
Niagara Falls	6.9	6.6
North Tonawanda	7.5	5.3
New York State	5.2	4.0

As seen, the unemployment rates for selected Erie and Niagara County communities dropped during the 1960–1970 period. Further, the entire area has a higher average unemployment level than does New York State. Even though 1970 is considered a recession year nationally, the above statistics indicate that the area had improved relative to the recession year of 1960. No readily available statistics were found for unemployment rates for the communities bordering the proposed Waterway. It is likely that unemployment in these communities is similar to the averages for the larger region for the major communities of the area. It is not conceptually possible, other than in isolated instances where knowledge of new industrial location exists, to estimate unemployment in any meaningful way over the 1980–2030 period. Unemployment in the area will be a function of several complex factors, including the national economic climate as well as factors operating to encourage or discourage industrial location and expansion in the Niagara and Erie County areas. One significant indication of the future trend in unemployment rates would be the continued stagnation of the industrial base in the Buffalo and Niagara Falls areas. If this trend continues, it can be predicted that unemployment rates for the region will remain above National and State of New York averages.

E-49 Public Services and Public Service Revenues

A major impact of the Waterway is likely to be the disruption of various forms of public services and an impact on the revenue sources

supporting these public services through loss of tax base or increased demands in greater proportion to increases in revenue sources. The public service that is most likely subject to disruption will be transportation. Depending on the community financial base, it is also likely that a large influx of workers would not add proportionally to the property tax base. Unless there is an income tax in the community, certain services would be subject to excess demands. School financing is primarily dependent on local property taxes, and this public service could be expected to be seriously impacted. Other services provided by various communities would be affected to the extent that increased demands for service resulting from the influx of transient workers are not supported by corresponding increases in general fund revenues, primarily derived from property or income taxes.

Transportation Services. Projecting the present transportation network over the next 60 years, other than to mention proposed beltways (LaSalle Expressway, Section 2 and Belt Expressway, Section 2), is not attempted. The most that can be assumed is that present highways will be maintained and that as population distribution within Niagara County expands to rural and suburban areas over the project life, highways will be upgraded and improved. It is assumed that present railway operation will be continued on the two existing lines near the southern end of the overland canal route and that any changes in these lines will be the result of changes in the economic and commercial factors determining their profitability to the railroad companies. For purposes of this report, it will be assumed that the rail lines will be kept in operation during the projected baseline period to 2030.

Present and Projected Property Values in the Project Region. Since construction of the Waterway will preempt some property from local tax roles and induce an influx of workers who may not support the level of services they demand in terms of additional revenues to communities, it is important to define and to provide rough estimates of present property value levels in the project corridor as well as the financing mechanisms that local communities employ. In Niagara County, for example, where 50 percent of the total land is in farms, agricultural property values, including land and buildings, are worth approximately $3,800 per acre. No readily available estimates were found for commercial, residential, or industrial property values for Niagara County. Other interesting property value statistics indicate that for Niagara County in 1970 the total assessed value was $707 million with a full market value of $1,239 million. Table E-11 shows a percentage of estimated market values and taxable property by type of property for Niagara County.[43]

TABLE E-11. MARKET VALUE BY PROPERTY TYPE FOR NIAGARA COUNTY, 1968[43]

	Estimated Market Value, million dollars	Percent of County Total
Commercial	179.0	13.9
Farm	62.5	4.9
Forest and vacant land	45.9	3.6
Industrial	199.4	15.5
One and two family residences	690.4	53.8
Public utilities	106.4	8.3
Total	1,283.6	100.0

In terms of growth, assessed valuation for Niagara County in 1967 was $519 million and $707 million in 1970. This is an annual increase of about 8 percent. At the same time market value increased $44.6 million or an annual growth rate of about 2 percent.

Since the Waterway will preempt certain portions of the county tax base, projecting levels of development of the tax base for the 1980-2030 period will be required to determine the approximate loss that the construction will entail. It is assumed that Niagara County is not expected to see significant major growth during the project period to 2030 and that growth which does occur will tend to be clustered in present urban areas or suburban areas. It is also assumed that the property values in the area will continue to remain in the agricultural, forest, and woodland classes. In certain instances, it can be assumed that changing land-use patterns will result in residential and suburban development along the Waterway or in fringe areas such as North Tonawanda, Bergholtz, Sanborn, and perhaps Wilson. Projection of the present growth rate and assessed value over the project period is the method used here for estimating future property value levels. It is also assumed that the property values affected generally will be those in the lower value classes.

In terms of local community financing, property taxes are generally a relatively small proportion of community general funds (ranging from 4 to 30 percent on an average national basis). On the other hand, school district financing is heavily dependent on the property tax and in some localities remains as high as 60 to 70 percent. No data were obtained for specific communities.

E-50 Social

Whiie it is important to evaluate a proposed project in terms of its effects on the physical and chemical environment and the biological environment, it is also important to include in the evaluation consideration of the effects on the baseline social environment. The social environment includes those specific characteristics and general activity patterns of people living in the immediate vicinity of the proposed project as well as those living outside of the immediate area who will be less directly affected. Although the important elements of the social environment that are subject to impact can be identified, data describing or quantifying these elements are extremely difficult to obtain without substantial surveying of the people living and working in the area. In this particular project, such extensive surveying was beyond the scope of work, but should be undertaken if an adequate Environmental Impact Statement is to be prepared.

In addition, because of major analytical constraints in the area of individual and community measurement, the interpretation of such data, where it is available, is difficult and often equivocal. The additional requirement of measuring the effects of changes in elements of the social environment (as would be ideal for a complete impact assessment) is complex and somewhat imprecise and was not considered given the time and dollar limitations of this project.

Even though faced with these serious limitations, the social environment cannot be ignored. For it is often the changes in the social environment and people's attitudes and feelings toward the anticipated effects that result in major alterations, delays, or even abandonment of proposed projects. More importantly, major adverse impacts should be identified so steps can be taken to mitigate or reduce them. Therefore, the Social Section of this report attempts to provide relevant information defining baseline social (but not explicately psychological) conditions, as well as some interpretation of these conditions in the locale of the proposed LE-LO Waterway.

E-51 Community Characteristics, Patterns, and Special Considerations

The intent of this section is to develop a baseline description of present social conditions of the human environment, complementary to the other sections of this report, particularly the other socioeconomic and aesthetic, recreational and cultural components. (An attempt was also made to project social conditions for the area in the year 2030 without the project.)

Any major construction project and particularly one with the magnitude of the proposed LE-LO Waterway will have important impacts upon community and individual characteristics within the project area. To aid in identifying and assessing these impacts, it is essential that these characteristics and important ongoing trends be defined. Social community characteristics include such attributes as population, age distribution, median income, education level, occupational and skill level, housing occupancy and availability, racial composition, and political and community participation. With the establishment of a baseline description of these characteristics it is possible to determine the potential positive and negative effects of community disruption. There are several important areas for which baseline conditions must be established and for which alterations and developments attributable to the project should be measured:

- Temporary or permanent additions to the community population
- Significant permanent or temporary changes in the age, sex, educational, income, occupational, and racial/ethnic distribution and composition
- Transitional or permanent disruptions in communication and interaction patterns during construction and operation of the facility
- Deterioration of psychological and physiological health resulting from construction and operation of the facility
- Alterations in political participation and recruitment into community organizations.

This section provides data presenting some of the general characteristics of the community and the relevant patterns of activities

occurring within the community. For purposes of this analysis, the "community" is generally defined as those census tracts in which the proposed LE-LO Waterway is located. In addition, data are provided for those census tracts in proximity to the Waterway route. The census tracts and their boundaries (Figure E-4) include:[52]

Census Tract	Boundaries
226	Niagara Township
227.01	Wheatfield Township
243.01	Town of Wilson
243.02	Wilson Township
243.03	Cambria Township
244.01	Town of Lewiston
244.02	Lewiston Township
244.03	Tuscarora Indian Reservation
245.01	Town of Youngstown
245.02	Porter Township

A report on the Niagara River environment summarizes some of the more important social characteristics of most of the towns and townships in the Waterway zone.[12] The summaries in Table E-12 provide background information and an introduction to this area. It should be noted that more recent projections indicate somewhat less population growth and thus, density for 1980 and 1990. Differences between the figures cited herein and the new population projections are not statistically significant, however.

Community Characteristics

This section refers to those characteristics and conditions that most adequately describe the population within the 10 census tracts defined in the LE-LO Waterway "community". These data, as provided by the 1970 Census, include information on population characteristics such as income, education, employment, housing occupancy, and racial composition.[44] In addition, data on voter registration and participation in presidential elections are presented. This information is given as an attempt to provide som background information for the communities in and around the proposed Waterway route and to provide more detailed information, supplementing that provided in the Economic Section. Interpretation of significant variations in these isolated data is difficult. However, these data serving as useful background information, generally indicate community characteristics.

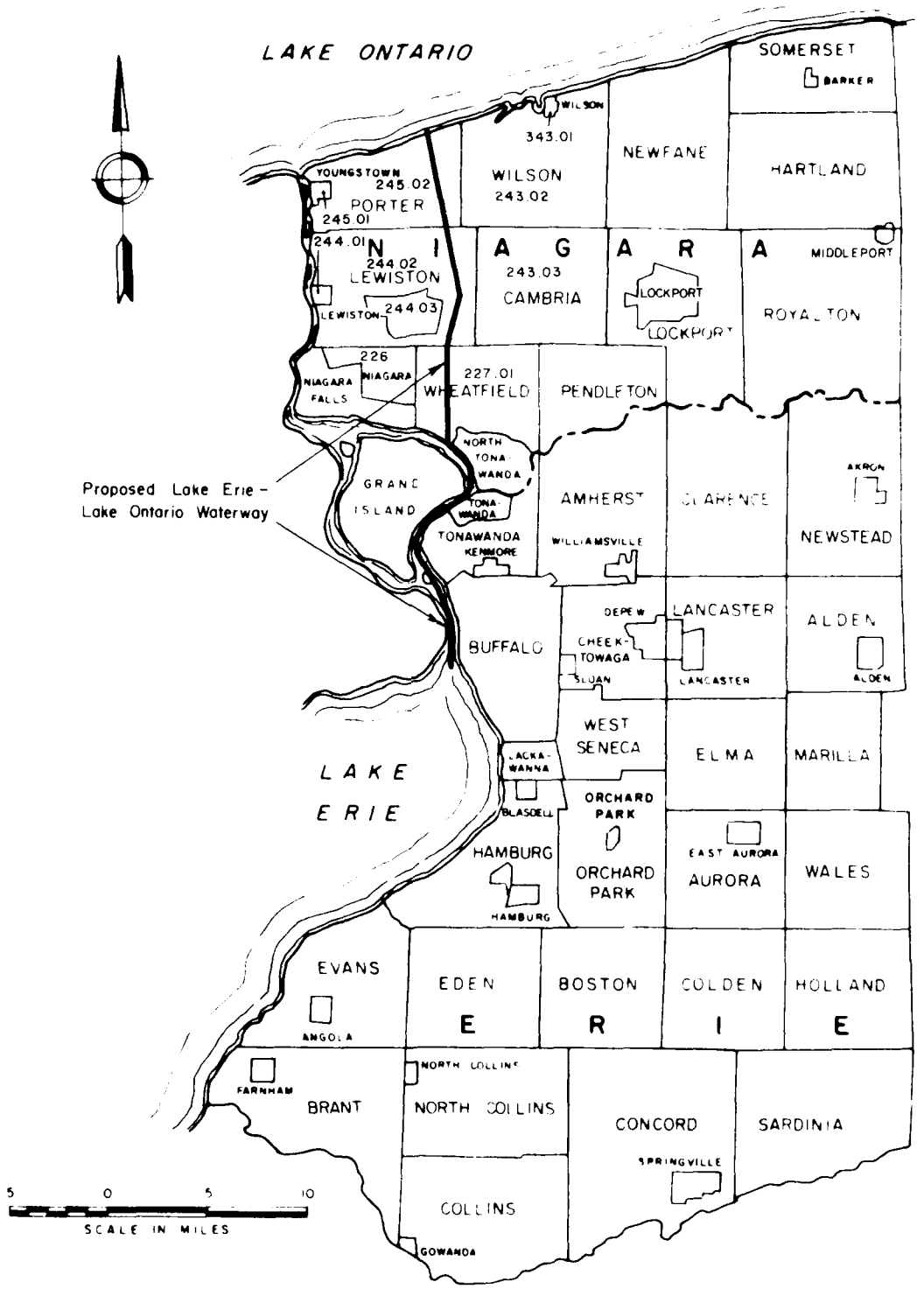


FIGURE E-4. CENSUS TRACK INCLUDED IN PROJECT ANALYSIS.

TABLE E-12. SUMMARY OF COMMUNITY CHARACTERISTICS OF TOWNS AND VILLAGES NEAR THE LE-LO WATERWAY[12]

Type and Character	General Land Uses	Areas of Undeveloped Land
City of North Tonawanda (Municipal, Niagara County)		
North Tonawanda is an older industrial community. Its shoreline is mostly taken up by factories. Downtown is cramped and many commercial buildings are deteriorating. Older housing stock is also in generally poor condition. There are some inadequacies in sanitary sewer service.	Land area = 10.5 sq. mi. Residential - Older housing east of waterfront industrial area; new housing in north (Wurlitzer Park). Commercial - Downtown section near mouth of Tonawanda Creek. Industrial - Along the waterfront, on Tonawanda Island, and in N. E. sector of city. Recreational - Parks scattered along Tonawanda Creek and river; a large public recreational complex, Holiday Park, is proposed for eastern portion of city.	Sizeable parcels of vacant land exist in the eastern portion of the city and along its northern boundary.
Town of Wheatfield (Incorporated Municipality With Residential Hamlets, Niagara County)		
The town is still predominantly rural, with scattered development especially along Niagara Falls Blvd. The river shore has been preempted by private development of poor quality. The lack of sanitary sewers has retarded development (the six-town sewer program will correct this situation by 1975.	Land area = 28.4 sq. mi. Residential - Predominantly farmhouses; residential hamlets at Walmore and Bergholtz in north and central portions; substantial trailer accommodations. Commercial - Strip development along Niagara Falls Blvd. Industrial - One industry located partially in town on Niagara Falls Blvd. Recreational - Oppenheim Park and Zoo.	Scattered parcels of land exist along the shore; large areas exist inland.

TABLE E-12. (Continued)

Type and Character	General Land Uses	Areas of Undeveloped Land
City of Niagara Falls (Municipal, Niagara County)		
The unique location of the city along the Gorge and Falls rim has made it one of the most popular tourist areas in North America. Tourist and commercial areas are, however, cramped for space (a large urban renewal project in downtown is to rectify this situation). Housing is predominantly medium-density, and much of it is in deteriorating condition. Sizeable concentration of heavy industry are located in the city. The city has combined storm and sanitary sewers.	Land area = 13.5 sq. mi Residential - Three sections: Deveaux (northwest); Central (near Falls); La Salle (east of River). Commercial - Downtown near Falls; strip commercial along N. Main, Pine, Buffalo Avenue. Industrial - Large complex along river north of Robert Moses Pkwy.; also industry east of Whirlpool and east of Hyde Park. Recreational - Hyde Park (interior); also state-owned Whirlpool Park and Niagara Reservation.	City is fully developed with the exception of scattered lots in industrial areas and along border with Town of Niagara. Certain industrial areas may be open for redevelopment as obsolete installations close.
Town of Niagara (Municipal - Niagara County)		
Niagara is a suburban community supporting a variety of land uses, including the Niagara Falls Airport. Development is mixed in a rambling pattern. Housing is predominantly single-family and mobile home. Transportation is excellent for the private auto. The lack of sanitary sewers has severely constrained development	Land Area = 19.8 sq. mi. Residential - Primarily in north-central portion; mobile home development along major arterials. Commercial - strip development along major arterial esp. Military Road. Industrial - strip development along I-90, northwest corner of town; eastern portion of town near Airport Recreational - No public facilities	Vacant land is scattered irregularly throughout the town. There is a large undeveloped area of process tailings from Union Carbide in the center of town.

TABLE E-12. (Continued)

Type and Character	General Land Uses	Areas of Undeveloped Land
Town of Lewiston (Incorporated Municipality With Residential Hamlets, Niagara County)		
This is a predominantly rural township with significant development occuring along its western side and portions of its southern boundary. Much of the town is taken up by the Robert Moses Power Complex and by the Tuscarora Indian Reservation. Highway access is good. Sanitary sewers to be provided by 1973 jointly with Porter.	Land Area = 40.2 sq. mi. Residential - Village of Lewiston on river shore; scattered areas above Escarpment, along Lower River Road and south of Power Complex. Commercial - Village of Lewiston. Industrial - South of Village of Lewiston there is significant industrial development. Recreational - Scattered marinas, Joseph Davis State Park, Reservoir S. P. Institutional - South of Village: Power Complex, Niagara University; north of Village, Stella Niagara Seminary.	South of the Village and west of the Power Reservoir is a sizeable area of vacant land. North of the Village, much vacant land exists beyond a one-lot depth from the River. Other sizeable areas of undeveloped land exist throughout the town.
Village of Lewiston (Under Municipal Jurisdiction of Town of Lewiston, Niagara County)		
The Village is predominantly quiet and residential. There are many early 19th century structures still in use. Transportation is adequate, although somewhat limited to the Parkway. The utility systems are adequate.	Land Area = 1.0 sq. mi. Residential - Virtually the entire village is residential. Commercial - Core along Center St. and on Water St. Industrial - Virtually none. Recreational - Lewiston State Park (proposed for southwest corner of Village).	A large parcel of land in the southern portion of the village is owned by the Power Authority.

TABLE E-12. (Continued)

Type and Character	General Land Uses	Areas of Undeveloped Land
Town of Porter (Incorporated Municipality With Residential Hamlets, Niagara County)		
Porter is primarily a rural-agricultural (orchards) town with small urban settlements at Youngstown and Ransomville. The Moses Pkwy. provides a good N-S transportation Route (E-W transit is poor). The Lewiston-Porter Joint Sanitary Sewer project will replace ineffective septic tanks by 1973.	Land Area = 33.5 sq. mi. Residential - Along major roads, in the villages, and along the River. Commercial - In Youngstown and Ransomville. Industrial - None of significance. Recreational - Scattered marinas, beaches, Ft. Niagara and Four Mile Creek State Parks. Institutional - Fort Niagara (Youngstown).	Most of Porter is sparsely developed. Some vacant land exists along the river. Orchards are situated between Lower River Rd. and the Parkway.
Village of Youngstown (Under Municipal Jurisdiction of Town of Porter, Niagara County)		
Youngstown is predominantly single-family residential with some multi-family development. A number of commercial and residential uses are made of its river banks. Transportation is good in a southerly direction via the Parkway. Utilities are adequate.	Land Area = 1.0 sq. mi. Residential - Multi-family in N.E. corner; single-family scattered throughout. Commercial - On Lower River Rd. atop the bluff; special river-related commercial at base of bluff. Industrial - None Recreational - Marinas and Ft. Niagara State Park. Institutional - Fort Niagara	A few parcels of vacant land exist above the bluff and east of Lower River Rd.

As indicated in Table E-13, the census tract with the largest population is that of Lewiston Township with a population of 12,596.[52] This does not include the Town of Lewiston or that area within the boundaries of the Tuscarora Indian Reservation. The next two largest tracts are those of Wheatfield Township (9,722) which includes the village of Bergholtz, and Niagara Township with a population of 8,368. The three tracts having the smallest populations are: Tuscarora Indian Reservation with 1,134; Town of Wilson with 1,284; and Town of Youngstown with 2,169.

TABLE E-13. 1970 POPULATION OF SELECTED CENSUS TRACTS

Census Tract	Name	1970 Total Population
226	Niagara Township	8,368
227.01	Wheatfield Township	9,722
243.01	Town of Wilson	1,284
243.02	Wilson Township	4,032
243.03	Cambria Township	4,193
244.01	Town of Lewiston	3,292
244.02	Lewiston Township	12,596
244.03	Tuscarora Indian Reservation	1,134
245.01	Town of Youngstown	2,169
245.02	Porter Township	5,260

Table E-14 categorizes the population of the 10 census tracts into three age groups: 1-19 years, 20-54 years, and over 55 years old.[52] Niagara Township and the Tuscarora Indian Reservation (244.03) have the smallest percentages over 55 years of age (10 percent and 11 percent), respectively. The town of Wilson (243.01) has the largest percentage (23 percent) of population over 55 years. The Tuscarora Indian Reservation has the largest percentage under 20 years of age (48 percent).

TABLE E-14. 1970 POPULATION BY AGE
(Selected Census Tracts)

Census Tract	AGE						Total
	1 - 19		20 - 54		55 - 75+		
	Number	Percent	Number	Percent	Number	Percent	
226	2750	45	3766	45	852	10	8368
227.01	3939	41	4218	43	1565	16	9722
243.01	462	36	531	41	291	23	1284
243.02	1721	43	1621	40	690	17	4032
243.03	1806	43	1807	43	580	14	4193
244.01	1239	38	1442	44	611	19	3292
244.02	5414	43	5429	43	1733	14	12576
244.03	544	48	467	41	123	11	1134
245.01	948	44	938	43	283	13	2169
245.02	2244	43	2079	40	937	18	5260

Table E-15 shows that the census tract with the lowest median income is that of census tract 244.03, the Tuscarora Indian Reservation ($7,221).[52] The next lowest are tracts 243.02 of Wilson Township ($9,432) and 226 of Niagara Township ($9,753). The tracts having the highest median income are 244.02, Lewiston Township ($12,788) and 245.01, Town of Youngstown ($12,417).

TABLE E-15. 1970 MEDIAN INCOME
(By Selected Census Tracts)

Census Tract	Median Income
226	$ 9,753
227.01	10,517
243.01	10,948
243.02	9,432
243.03	10,050
244.01	11,887
244.02	12,788
244.03	7,221
245.01	12,417
245.02	10,232
County	
Erie	10,482
Niagara	10,203
Total SMSA	10,430

Data in Table E-16 shows that the population of Tuscarora Indian Reservation (244.03) has completed the least number of years in school (10.5) on an average.[52] All of the other tracts had a range of 11.5 years to 12.7 years completed. The three towns, of Youngstown (245.0), Lewiston (244.01), and Wilson (243.02), and the township of Lewiston (244.02) have the highest percentage of graduates from high school (72.9, 71.6, 66.2, and 67.5, respectively). Again, the Tuscarora Indian Reservation is the lowest of the 10 census tracts with only 32.1 percent of the population having graduated from high school.

Table E-17 provides information by census tracts supplementing that given in the Socioeconomic Section of this chapter.[52]

Table E-18 indicates occupancy and ownership of the housing units in the area.

In six of the census tracts, 18 percent or less of the housing units available are rental units. The Town of Youngstown (245.01), Niagara Township (226), Town of Lewiston (244.01), and Town of Wilson (243.01) have the largest percentage of housing units for rent in the 10 tracts with 35 percent, 26 percent, 25 percent, and 21 percent, respectively. These figures give evidence that there are relatively few housing units available for rent in the Waterway community.

Table E-19 indicates that the census tracts of the LE-LO community have a predominantly white population.[52] The only tract with greater than 1 percent Negro population is Niagara Township (226) with 3.3 percent. Three tracts, the Town of Wilson (243.01), the Town of Lewiston (244.01), and the Tuscarora Indian Reservation (244.03) have no Negro residents.

Table E-20 provides information on voter participation in Niagara and Erie Counties in the 1964 and 1968 Presidential Elections.[53,54] It also indicates voter registration and enrollment for the two counties in 1969. The present New York regulations for voting in village, city, or state elections require a 3-month period of residence preceding an election which would probably preclude political participation by the more transient members of the immigrant labor force associated with the facility.

TABLE E-16. YEARS OF SCHOOL COMPLETED
(By Selected Census Tracts for Persons 25 Years or Older)

Education Level	Census Tract									
	226	227.01	243.01	243.02	243.03	244.01	244.02	244.03	245.01	245.02
Persons 25 Years or Older	4,003	5,218	743	2,070	2,069	1,853	6,146	532	1,172	2,690
No School Years Completed	47	27	--	--	12	21	19	5	--	4
Elementary										
1-4 Years	82	46	15	22	32	29	62	--	16	30
5-7 Years	299	470	74	171	141	117	285	102	54	198
8 Years	492	721	42	347	339	107	519	67	88	282
High School										
1-3 Years	948	1,306	120	585	400	253	1,112	187	160	527
4 Years	1,556	1,934	263	644	853	647	1,990	139	359	966
College										
1-3 Years	356	449	88	162	153	313	892	11	190	327
4 Years or More	229	265	141	139	139	366	1,207	21	305	356
Median School Years Completed	12.1	12.0	12.5	11.5	12.1	12.6	12.5	10.5	12.7	12.3
Percent High School Graduates	53.3	50.7	66.2	45.7	55.3	71.6	67.5	32.1	72.9	61.3

TABLE E-17. EMPLOYMENT BY OCCUPATION AND INDUSTRY (52)
(By Selected Census Tracts)

	Census Tract									
	226	227.01	243.01	243.02	243.03	244.01	244.02	244.03	245.01	245.02
Occupation										
Total employed, 16 years old and over	2,554	3,666	496	1,446	1,463	1,350	4,437	316	787	1,778
Professional, technical, and kindred workers	292	491	129	154	140	321	1,048	38	191	262
Health workers	45	38	23	22	16	69	164	10	20	31
Teachers, elementary and secondary schools	72	128	82	57	74	43	213	12	86	77
Managers and administrators, except farm	158	160	31	36	63	177	516	10	182	153
Salaried	105	104	20	36	53	169	487	10	174	133
Self-employed in retail trade	37	32	5	--	10	5	5	--	4	10
Sales workers	126	243	46	49	65	93	261	28	65	146
Retail trade	101	173	29	34	38	52	146	28	36	70
Clerical and kindred workers	433	532	63	131	222	216	695	26	62	222
Craftsmen, foremen, and kindred workers	462	769	97	267	265	168	678	62	99	303
Construction craftsmen	138	115	24	93	77	58	194	25	26	99
Mechanics and repairmen	97	194	37	57	51	23	140	16	29	76
Operatives, except transport	540	801	57	407	303	113	466	62	67	270
Transport equipment operatives	156	211	--	72	79	17	117	12	25	104
Laborers, except farm	132	127	14	80	69	71	139	26	10	47
Farm workers	7	27	5	109	110	--	131	23	5	73
Service workers	240	301	50	128	147	160	376	23	81	165
Cleaning and food service workers	143	202	29	65	85	84	187	16	49	93
Protective service workers	19	46	--	9	10	4	38	--	5	17
Personal and health service workers	74	45	17	50	52	64	120	7	21	51
Private household workers	8	4	4	13	--	14	10	6	--	33

TABLE E-17. (Continued)

	Census Tract									
	226	227.01	243.01	243.02	243.03	244.01	244.02	244.03	245.01	245.02
Industry										
Total employed, 16 years old and over	2,554	3,666	496	1,446	1,463	1,350	4,437	316	787	1,778
Construction	111	148	38	73	109	50	248	37	56	72
Manufacturing	1,140	1,752	121	685	635	429	1,645	106	236	725
Durable goods	630	1,162	70	416	414	212	854	46	100	437
Transportation	94	134	--	55	53	9	76	12	12	63
Communications, utilities, and sanitary services	69	76	5	20	22	37	121	--	26	11
Wholesale trade	63	119	10	48	31	24	114	--	22	42
Retail trade	493	592	63	120	169	238	573	50	83	216
Finance, insurance, and real estate	86	98	22	15	11	64	154	10	31	70
Business and repair services	16	81	10	10	11	12	71	--	15	20
Personal services	62	81	14	21	31	86	101	6	20	70
Health services	116	81	43	93	84	159	290	10	31	82
Educational services	124	261	126	108	135	81	585	12	151	139
Other professional related services	62	99	14	21	27	58	155	26	25	62
Public administration	71	87	20	38	30	51	121	6	64	122
Other industries	47	57	10	133	115	52	183	41	15	84

TABLE E-18. HOUSING OCCUPANCY[52]
(By Selected Census Tracts)

Census Tract	Total	Owner Occupied	Renter Occupied	Percent For Rent	Vacant Units			
					Year-Round	For Sale Only	For Rent	Other
226	2261	1,595	591	26	75	3	13	59
227.01	2882	2,383	452	16	47	4	14	29
243.01	457	343	95	21	19	4	7	8
243.02	1165	968	161	14	36	7	3	26
243.03	1149	919	192	17	38	9	13	16
244.01	1022	736	254	25	32	10	8	14
244.02	3129	2,758	317	10	54	13	10	31
244.03	327	250	63	18	14	1	--	13
245.01	667	394	240	35	33	16	8	9
245.02	1454	1,140	260	18	54	13	12	29

TABLE E-19. RACIAL COMPOSITION OF POPULATION[52]

(By Selected Census Tracts)

Census Tract	Population		Percent Negro
	White	Negro	
226	8,042	272	3.3
227.01	9,697	8	0.1
243.01	1,283	-	-
243.02	3,973	22	0.5
243.03	4,168	11	0.3
244.01	3,283	-	-
244.02	12,513	17	0.1
244.03	348	-	-
245.01	2,163	1	-
245.02	5,206	3	0.1

TABLE E-20. VOTER PARTICIPATION[53,54]

Year	Participation in Presidential Election Niagara County	Erie County
1964	95,985	471,576
1968	89,683	461,289
	Voter Registration	
1969	87,799	548,563
	Voter Enrollment	
1969	91,568	504,410

Community Activity and Integration Patterns. This section addresses the complex, imprecise, but extremely impact-sensitive elements of human life styles and activities that contribute to community integration through interaction networks within a specific area. These elements are important because they essentially define the life patterns of people within the community. In addition, these elements define particular characteristics that make the community unique to its residents, as well as to outsiders. Included in this factor are social clubs, service organizations, church- and school-related activities, political activities, as well as less formal interactions, such as neighbors visiting neighbors. This factor also includes the economic activities and patterns of movement which involve the acquisition or exchange of goods and services, such as general shopping, banking, insurance, dental, and medical care.

Most of these patterns of activities are partially dependent upon the transportation routes and systems of the area. If changes or disruptions occur in the transportation and road systems servicing the area, then incumbent changes and disruptions in community activities and interactions can be expected to occur. Recent experience has indicated that linear obstructions such as limited-access highways, or as in this case a canal, can have significant effects on the nature of community integration and interactions. Even though it is still difficult to identify these elements and to anticipate changes that will occur in them, it is very important to point out the likelihood that they will be considerably impacted.

Although it is important to attempt to evaluate the LE-LO Waterway in terms of its effect on these elements of community activity

patterns, it was not possible in this preliminary study to become well enough acquainted with the project area to identify the various patterns and activities. Unfortunately, no pertinent existing data were found to be available either. Evaluation of the baseline conditions and the effects upon these elements requires comprehensive and intimate knowledge of the community. This information is often best obtained by a research team familiar with the activities of people in the project area and requires sufficient time to identify variations within local patterns. Although it was not feasible to study such primary elements, they are mentioned in this baseline description to suggest that they should be dealt with when a later, more detailed impact analysis of the proposed project is undertaken.

Special Considerations

In addition to the generalized base-area population for which some important characteristics have been summarized in Table E-12, two groups have been identified in this baseline social and community description as requiring separate special considerations. These groups have sufficiently different characteristics from the others in the region to require special consideration. These include (1) the Tuscarora Indians living on the Tuscarora Indian Reservation and (2) the indigenous long-time residents of Bergholtz and surrounding areas who are descendents of the original German settlers in the proposed Waterway-impacted area.

E-52 Aesthetic, Recreational, and Cultural Environment

E-53 Educational/Scientific Packages

This section focuses attention on unique natural or cultural features – either sites or objects – of the environment which are of educational or scientific value. They are of interest or value because of their capability to enhance educational or scientific knowledge. Unique natural features include ecological and geological phenomena; and unique cultural features include artifacts of archeological and historical importance.

To measure the value of those things identified as unique natural or cultural features, all occurrences identified within each of these two general categories are combined and thought as total "packages" of occurrences. That is, there would be one "unique natural features

package" including all relevant occurrences of ecological or geological value, and one "unique cultural features package", including all relevant occurrences of archeological or historical value.

E-54 Unique Natural Features

This category refers to those places of value or interest because of their particular ecological or geological nature. "Ecological" refers to plant and animal life and their value as educational and scientific examples of interrelationships between organisms and their environment. An example of such a place is the habitat of an endangered or rare species of a plant or animal. Other sites of ecological interest include either natural or man-made wildlife refuges and swamps, marshlands, or forests which are illustrative of life processes, or locally unique environments that are in short supply within the area.

The word "geological" refers to those areas of the natural environment which contribute to educational and scientific knowledge of the history of earth and its life as recorded in rocks and rock structures. It also refers to geologic phenomena that serve to illustrate unusual processes.

Two areas have been identified along the proposed Waterway route as having specific educational and scientific ecological value. The first is the Tuscarora Indian Reservation which primarily because of its land-use pattern, supports the only substantial existing natural open-space habitat for many plants native to the area. The second is the developing Bond Lake area. This lake has served as the subject of masters theses for students of Niagara University, as well as serving the residents of the area as a wildlife laboratory within the area.

Of particular geological interest is the Niagara Escarpment through which the Waterway route passes. The Escarpment is an excellent example of unusual geologic phenomena and could serve as a source to enhance knowledge concerning geology and geological processes.

E-55 Unique Cultural Features

This category refers to those places which are of interest because of their special archeological or historical aspects. Phenomena of archeological value include all sites, objects, or structures which, at the present time or in the future, may contribute to human knowledge and understanding of biological or cultural processes in prehistoric

or historic times. Archeological sites are basic elements in revealing anthropological features of prehistoric times. Destruction of such sites means destruction of potentially essential historic or cultural anthropological artifacts. Therefore, the archeological and historical resources in the project area should be identified by state, university, or National historical or archeological authorities such as the Smithsonian Institution and the value of these resources should be evaluated.

Sites, objects, or structures are defined as being of historical value because of their relationship in history to important events, persons, religions and cultures, and particular styles in architecture. This includes sites important in local, state, or National history.

A review of the available information indicates that there are no known archeological sites in the project area. However, it does not appear that much exploration has been undertaken to identify such sites in the area. Therefore, exploration of such sites in the area should be undertaken prior to construction, especially in consideration of its unique location at the crossroads of natural water and land transportation routes, offering an apparently ideal community location.

Considering the present trend of interest in the value of archeology and archeological sites, it can be anticipated that if such sites are identified, interest in and appreciation of them may be high.

The following sites and structures of historical value have been identified:

(1) Relevant to historical events: The waterway area was traversed by early Great Lakes explorers, and several important battles took place in the area. The area was crossed by Brulé during his explorations of the Niagara River, Lake Erie and Huron areas in 1615–1618. Joliet further explored the area during his expedition of the region in 1618–1619. Local historical sources suggest that there were at least significant troop movements across the proposed Waterway route during early 17th and 18th Century French-English-Indian development and the French-Indian War, the Revolutionary War, the War of 1812, and the abortive Canadian Rebellion of 1837–38 in which Canadian insurgents occupied Navy Island in the Niagara River. When the Canadian government attempted to seize the insurgents' steamer Caroline, the infamous "Caroline

Affair" became an international incident, and several skirmishes occured in the Niagara Frontier area. The area also served as an important terminal in the Underground Railroad transporting runaway slaves from the United States to Canada[55] during the first half of the 19th Century.

(2) Relevant to religions and cultures of historical interest: The east section of the Bergholtz Cemetery - the oldest part of the cemetery - dates back to 1843, and Indian burial areas date at least back to the Woodland Culture period (500 B. C. -A. D. 500). Remnants in the area have been identified with the Point Peninsula Coastal Woodland Culture, dating to 500 B. C. or earlier. Artifacts have also been identified with the Owascoid culture of the late Woodland period (500 A. D. - 1300 A. D.) in the Niagara Frontier area. Later Wenro and Erie Iroquoian linguistic stock inhabited the region until their emigration west was precipitated by advancing hordes of white settlers.

(3) Within the town of Bergholtz and the surrounding area are a number of residents who have recently taken a strong interest in preserving certain buildings and structures of characteristic styles and architecture. Several buildings are being restored by this group, and one original log structure, one block from the Bergholtz Cemetery, is being purchased for restoration and preservation. The objective of this local effort is to preserve and renovate certain buildings in order to preserve elements of the German culture established by the original settlers and immigrants to this area.

No National Register properties have been identified in the immediate Waterway route area. However, two sites listed in the National Register of Historic Places are located within 50 miles of the proposed Waterway route.[56] They are the Niagara Reservation (Niagara Falls) and Old Fort Niagara located near Youngstown.

While no other National Register properties are currently listed for this area, future acquisitions may alter this situation. A complete survey taken just prior to the purchase of land for the Waterway will be required. This survey should be conducted and reported in conformance with the guidelines promulgated by the National Advisory Council on Historic Preservation as well as local and state historical society guidelines and advice.

E-56 Recreation

E-57 Recreation Supply

In the following section, recreation facilities and trends are discussed for seven zones.[57] The zones are the City of Buffalo Zone, Developed Zone, Active Fringe Zone, Moderate Growth Zone, and Rural Zone shown in Figure E-5; and the Canadian Water Frontage Zone, and Canadian Peninsula Interior Zone shown in Figure E-6.

Recreation facilities are grouped in five categories, according to the following descriptions:

- Community Parks are outdoor recreation areas larger than 25 acres. They are generally day-use facilities where activities such as picnicking, golfing, field sports, passive recreation, and, occasionally, swimming and boating predominate. Their primary service area has a radius of approximately 2 to 4 miles. Their clientele is almost exclusively local. For the purposes of this study, this category is composed exclusively of municipal park lands.

- Regional Parks are outdoor recreation areas of broader regional significance. Typically, their facilities provide for a wide range of activities, including overnight and extended-stay camping, boating, hiking, nature study, and winter sports, in addition to day-use facilities. Many regional parks include unusual physical or scenic resources of special interest. Such areas are typically administered by county, state, provincial, or National agencies. These parks serve a regional, state, or for the facilities in the area of the falls of the Niagara River, even international clientele. All county or state parks have been considered as regional for the purposes of this study.

- Regional Special Purpose Areas are facilities of regional or broader significance but dedicated to a single type or more restricted spectrum of use. Included in this category are wildlife areas, reservoirs (with other nonrecreation uses), and special historic or scientific sites.

- Recreation-Open Space Corridors are linear facilities for recreation travel by car, horse, bicycle, or on foot. In addition to recreation functions, such corridors may be valuable as urban open space or as a means of flood-plain protection.

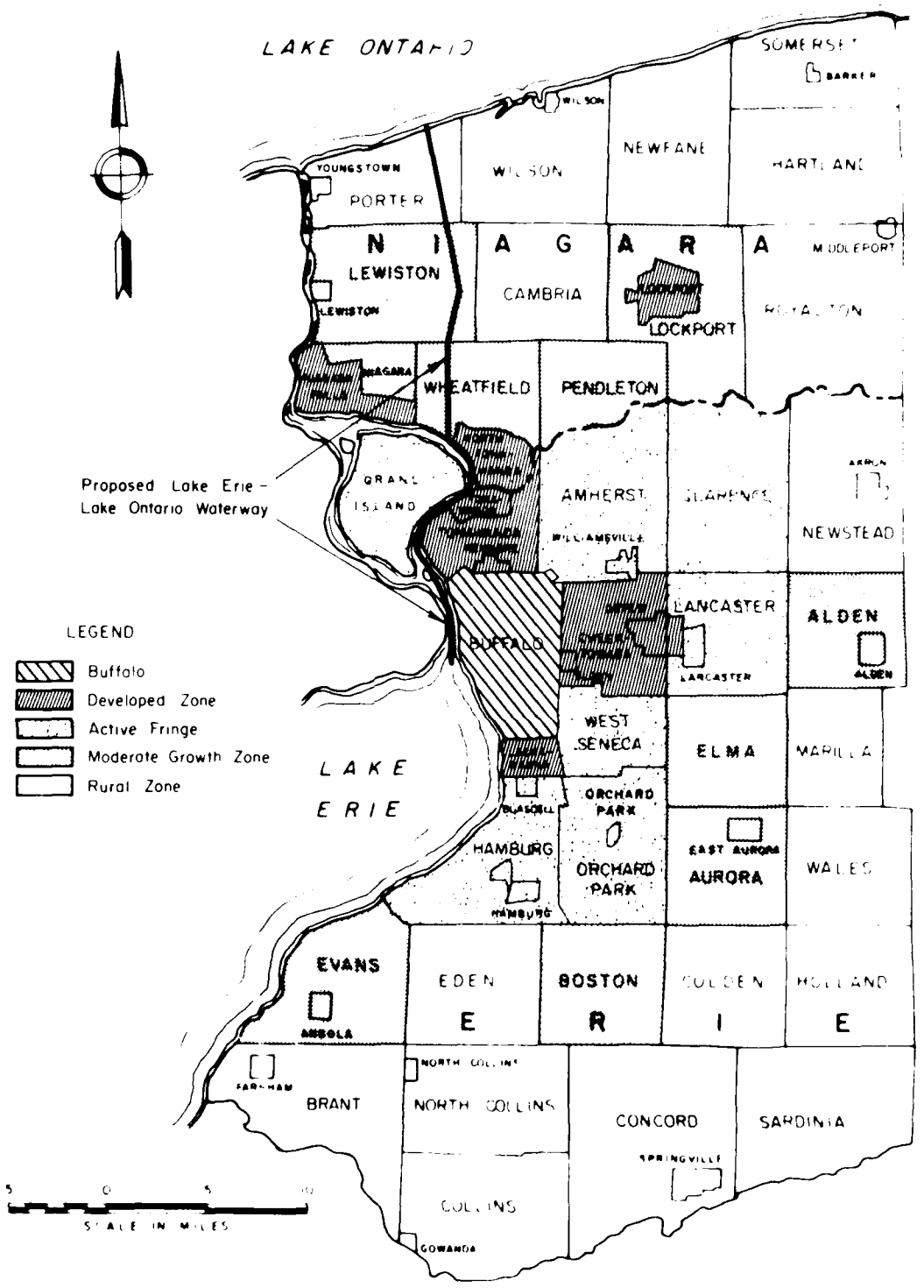


FIGURE E-5. RECREATION ANALYSIS ZONE, U.S.

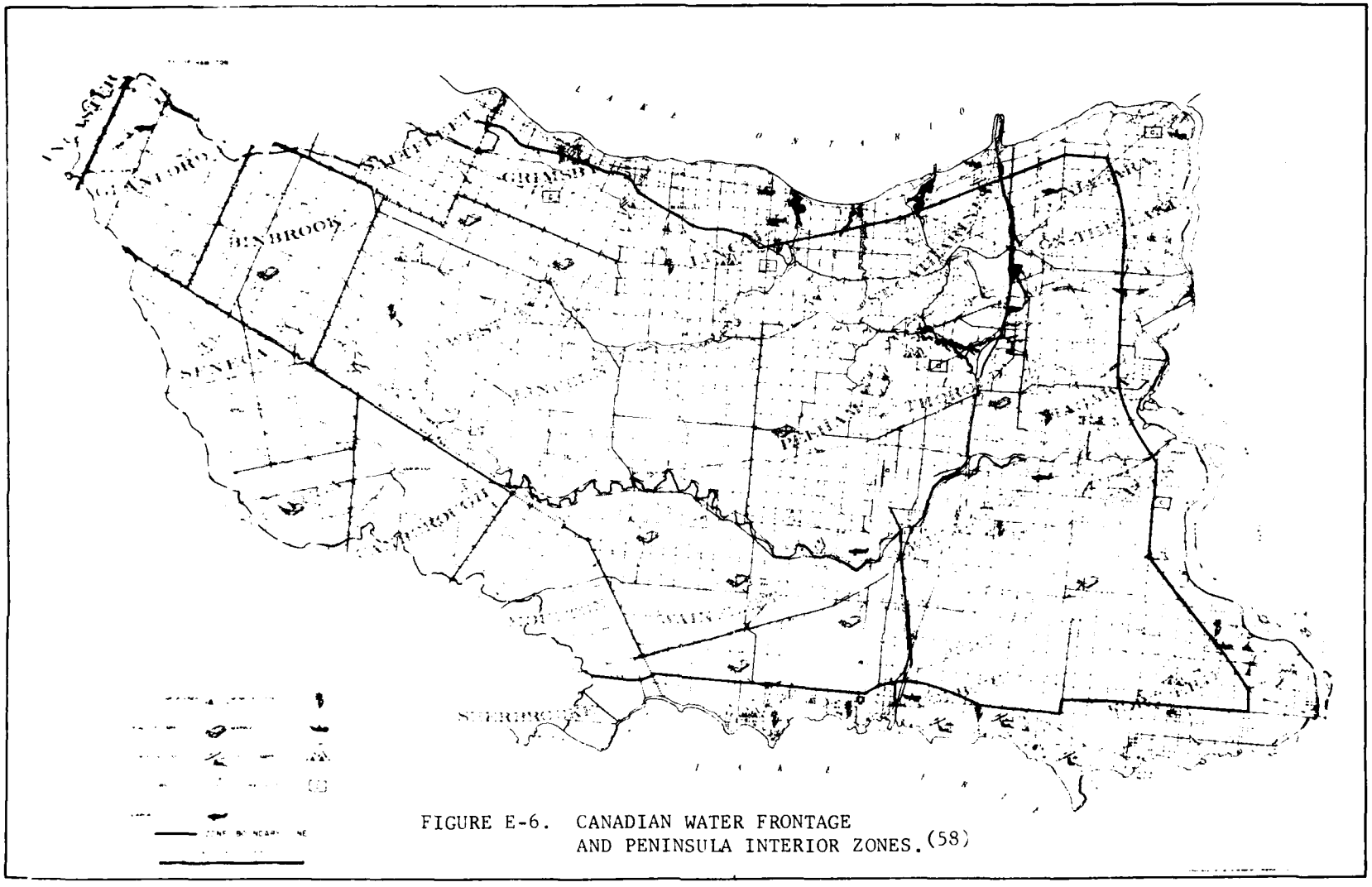


FIGURE E-6. CANADIAN WATER FRONTAGE AND PENINSULA INTERIOR ZONES.(58)

- Tourist-Oriented Facilities are intensive-use areas not dependent on a natural-resource base. Spectator-sport stadiums, observation towers, amusement parks, and theaters are typical examples. Their users are frequently nonlocal, or for sports arenas, event-oriented.

Summaries of existing and 1990 proposed facilities in each of the recreation categories are shown in Tables E-21 and E-22 by zone.[44]

Buffalo Zone. A 1968 report by the Buffalo City Planning Department reported 1,444 acres of parks and recreation open space in Buffalo.[59] Community parks contain 1,095 acres, the remainder occurring in smaller parks of less than 25 acres.[57] No regional parks or corridors are within Buffalo. Special-purpose and tourist-oriented facilities include a music hall, three museums, two stadiums, theaters, a zoo, and an observation tower atop City Hall. Riverfront recreation access is limited, although marinas exist along the New York Barge Canal Terminal and Upper Black Rock Harbor. Two boats tour the river and Lake Erie area. The city concentrates on accommodating conventions and is not primarily tourist directed. Tourism is reduced, in part, because "the poor environmental quality of the waterfront and the lack of comprehensibility and focus in the downtown area create an unfavorable impression on the typical tourist".[12]

Developed Zone. This zone includes the cities of Niagara Falls, Lockport, Lackawanna, North Tonawanda, and the Town of Tonawanda. Fourteen community parks totalling 1,187 acres are concentrated in the city and Town of Tonawanda (600 acres) and Niagara Falls (470 acres). An additional 680 acres of regionally significant parks in the zone include 586 acres in three state parks in Niagara Falls.[57]

The Niagara Falls area is heavily tourist oriented with numerous commercial facilities supplementing the state parks along the Niagara River. Other special regional facilities include observation areas and a visitor center at the Moses Power Project, the Niagara Falls Aquarium, and a historic museum. The Robert Moses Parkway along the river facilitates tourist traffic but provides minimal recreational opportunities and is best regarded as a transportation rather than recreation corridor.

TABLE E-21. PUBLIC RECREATION ACREAGE[44]

	Community Parks				Regional Parks				Total
	Existing	Proposed[b]	Total	1990 a/1000 p[a]	Existing	Proposed[b]	Total	1990 a/1000 p[a]	1990 a/1000 p[a]
Buffalo Zone	1095	50	1145	3.0	--	--	--	--	3.0
Developed Zone	1187	213	1400	4.6	680	710	1390	4.6	9.2
Active Fringe Zone	702	800	1502	2.4	3497	2880	6377	10.3	12.7
Moderate Growth Zone	281	1625	1906	14.4	2532	6167	8699	65.9	80.3
Rural Zone	94	1225	1319	12.3	4156	4538	8694	81.3	93.6
U. S. Total	3359	3913	7272	4.7	10,865	14,295	25,160	16.4	21.1
Canadian Water Frontage Zone	78				3870				
Canadian Peninsula Interior Zone	616				1454				
Canadian Total[c]	694			1.9	5324			14.5	16.4

(a) Acres per 1000 population.

(b) Quantitative data on Canadian proposed recreation acquisitions are not available.

(c) Based on 1970 population and combining data from the two Canadian zones. Only public facilities are included in totals.

TABLE E-22. SPECIAL RECREATION FACILITIES

	Regional Special Purpose Facilities		Open Space Corridors		Tourist-Oriented Facilities	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
Buffalo Zone	Stadium, museums, zoo, music hall	--	--	--	Observation towers, boat tours	--
Developed Zone	Niagara Frontier Parks, observation area, power project	--	Moses Parkway	Limited stream corridors	Extensive commercial development	Urban renewal City of Niagara Falls
Active Fringe Zone	Buckhorn Island wildlife area	--	West River Parkway	Stream corridors, N.Y. barge canal	Typical commercial facilities	--
Moderate Growth Zone	Moses power reservoir	--	--	Numerous corridor and trailways, Niagara Escarp, and N.Y. barge canal	Moderate commercial facilities	--
Rural Zone	10,054 acres of reservations, Fort Niagara	6000-acre addition Zoar State Forest, several reservoirs	--	Lk. Ontario Pkwy., numerous stream corridors, Niagara Escarp. Trwy.	Minimal commercial facilities	--
Canadian Water Frontage Zone	Extensive cottage development, observation towers, amusement park, private beaches and campgrounds, Old Fort Erie historic site, Niagara-on-the-Lake	--	Niagara Pkwy.	Extensive corridor facilities	Extensive commerical development including camping areas, pools, beaches	--
Canadian Peninsula Interior Zone	Nature reserves, Welland Canal	--	Bruce Trail	Extensive additional corridors	--	--

The park facilities in this zone are principally day-use, tourist-oriented facilities providing river and falls observation, picnicking, and, in the state parks, hiking and bicycling. These facilities do not include camping or swimming-boating areas.

Proposed community park additions total 213 acres, primarily in resident-oriented parks in Lockport. Regional acquisition proposals of the Planning Board include 710 acres, mostly in Tonawanda and Lockport.

The Active Fringe Zone. This area, including the towns of Grand Island, Amherst, Clarence, Lancaster, and others south of Buffalo, has experienced the region's most rapid growth in recent years. It is expected to absorb "the bulk of the region's population increase to the year 1990".[57] The zone contains 4,200 acres of park land, 702 acres of which is in community parks and 1,814 acres are in two state parks on Grand Island. Only Grand Island and the town of Hamburg, south of Buffalo, border Lake Erie or the Niagara River. The Grand Island parks, Buckhorn Island on the north and Beaver Island on the south, are connected by the West River Parkway. Buckhorn is a popular wildlife sanctuary with well-used nature trails. Beaver Island State Park includes the only public beach on the Niagara River. Both are day-use areas.

Areas northeast of Buffalo are particularly deficient in recreation space and are separated from the riverfront recreation areas by a major belt of urbanization.

Proposed community park additions, totalling 800 acres, are concentrated in the town of Hamburg. Several proposed open space corridors would link the zone to outlying areas, including the New York Barge Canal (Erie Canal).

Moderate Growth Zone. This zone, lying outside the predominantly urban area of the region, is characterized by a comparatively large acreage of county and state park land. Of the present total of 2,813 park acres, 2,532 acres are in such regional parks.[57] These are primarily day-use facilities with little camping, swimming, or boating. This zone lacks adequate smaller community park facilities.

Proposed acquisitions to 1990 include 1,625 acres of community parks and 6,167 acres of regional parks. Much of this acreage is in open space corridors and trailways. Of special prominence are the proposed Niagara Escarpment Trailway and portions of the New York Barge Canal.

Rural Zone. The outlying sections of Erie and Niagara Counties contain only 94 acres of community parks but a relatively large acreage of regional parks scattered in large blocks. Four state parks and one county park along the Lake Ontario shore total 1,550 acres. Boating, picnicking, and fishing are the major activities. An additional 10,054 acres of open space in the zone is contained within Zoar and Tonawanda State Forests and 11 Erie County Forest Preserves. These areas provide a minimum of developed recreation facilities, nearly all hunting and fishing related. Fort Niagara, at Youngstown, is a prominent historic site and tourist attraction. Existing regionally significant park lands in the zone total 4,156 acres, excluding the state and county forests.

Proposed community park additions of 1,225 acres and regional park additions of 4,538 acres would include a large acreage in open space corridors and trailways. Not included in these figures are a proposed 6,000-acre addition to the Zoar State Forest and a proposed Lake Ontario Parkway. Six to nine reservoirs with recreational potential have also been proposed for this zone.(60)

Canadian Water Frontage Zone. This zone consists of three separate linear segments: the Lake Erie shoreline, the Lake Ontario shoreline, and the Niagara River park lands. The Lake Erie strip contains 220 acres of public recreation land and approximately 377 acres of privately owned land open to the public.(61) Of the public acreage, 142 acres are contained in the Long Beach Conservation Area operated by the Niagara Regional Conservation Authority. The remaining 78 acres are in community parks in Port Colborne and Wainfleet. Only these publicy owned areas have been included in summary Table E-21. These facilities are of area-wide significance since they provide virtually all the swimming and beach access on Lake Erie in the region. An amusement park (Crystal Beach), overnight camping for over 400 units at Sherkston, and several marinas complete the facilities picture.

Much of the Lake Erie shoreline is utilized for private cottages. An accurate estimate from Ontario Hydro data indicates that in 1970 approximately 1,350 cottages along the Erie shore were served by Ontario Hydro.(61)

Facilities along the Lake Ontario shore are more limited, due in part to colder waters and less extensive beach areas. Seventy-nine areas of public land provide fishing, swimming, and some camping. The only area larger than 25 acres, Charles Daley Park, provides 90 camping spaces heavily used by tourists. Private facilities in the area provide another 110 spaces, largely used by tourists. Several marinas serve the area, principally in St. Catharines.

The Niagara Parks Commission administers over 3,700 acres of park and recreational lands along the Niagara River. These lands serve a wide variety of functions, including facilities for swimming, camping, picnicking, nature study, and, of course, sightseeing. The most notable features of this system are the Niagara Parkway, Queen Victoria, Queenston Heights Parks, and a large nature reserve at Navy Island Park. An additional 60 acres of public recreation areas are provided in historic sites at Old Fort Erie and McFarland Point. Privately operated facilities total approximately 35 acres and feature camping space and pools, largely in conjunction with motels. Both public and private boat-oriented facilities and marinas are operated along the river.

The Canadian Niagara River parklands are major tourist areas of international reputation. The varied facilities also serve local and regional recreation functions.

In addition to the park lands, an extensive private commercial tourism sector exists in the area, principally in the City of Niagara Falls. Niagara-on-the-Lake has been developed as a historical-cultural center, attracting large numbers of tourists.

Canadian Peninsula Interior Zone. Recreation facilities in this zone include 1,100 acres of public lands along the Niagara Escarpment and 970 acres elsewhere on the peninsula.(61) Much of this acreage (approximately 1,000 acres) is in large natural reserves such as the St. Johns and Balls' Falls Conservation Areas and the Effingham area lands of the Ontario Department of Lands and Forests. Approximately 616 acres of the public lands are in local parks of community significance. Considerable private facilities in the zone accent swimming pools and camping areas, usually in

conjunction with motels. The Bruce Trail traverses the area for 46 miles along the Escarpment. The trail is a popular hiking route of regional significance. The Welland Canal, crossing the peninsula north-south, is a tourist attraction but provides a minimum of recreation facilities. A visitor information booth and observation deck in St. Catherines and scattered picnic tables along the route are the extent of present canal facilities.

The recreation potentials of lands within the two Canadian zones have been extensively studied.[62] Patterns of public acquisition and development that have been recommended generally employ recreation-open space corridor concepts.[58] As these recommendations have not been expressed in acreages, they cannot be interpreted in projected acres per 1,000 population. The location of existing and proposed facilities is shown in Figure E-7.[58]

E-58 Recreation Demand - Current and Projected

Recreation demand is a complex phenomenon that is generally hard to measure and even more difficult to predict. Current use of facilities is one indicator of demand, determined by an unspecified interaction of demographic, cultural, facility, and access factors. Even when adequately measured and related to these underlying variables, use is at best a partial surrogate for demand since potential or unexpressed demand is excluded. Because detailed data and demand models are rarely available, recreation standards have long been used as rule-of-thumb indicators of recreation needs. In the following analysis, recreation standards adopted by the Erie and Niagara Counties Regional Planning Board have been utilized.[58] These standards recommend the following ratios of park acreage to population (acres per 1000 population):

Community parks (including neighborhood)	5.0
Regional parks	5.0
Open space, special purpose parks and corridors	15.0
Total	25.0

As an aid to determining local activity preferences, studies by the Ontario Department of Tourism based on a Toronto sample have been used.[61] Results of these studies have been reproduced in Tables E-23, E-24, and E-25. Since comparable data on the LE-LO Waterway project region are not available, the patterns similar to those found in the Ontario survey have been assumed.

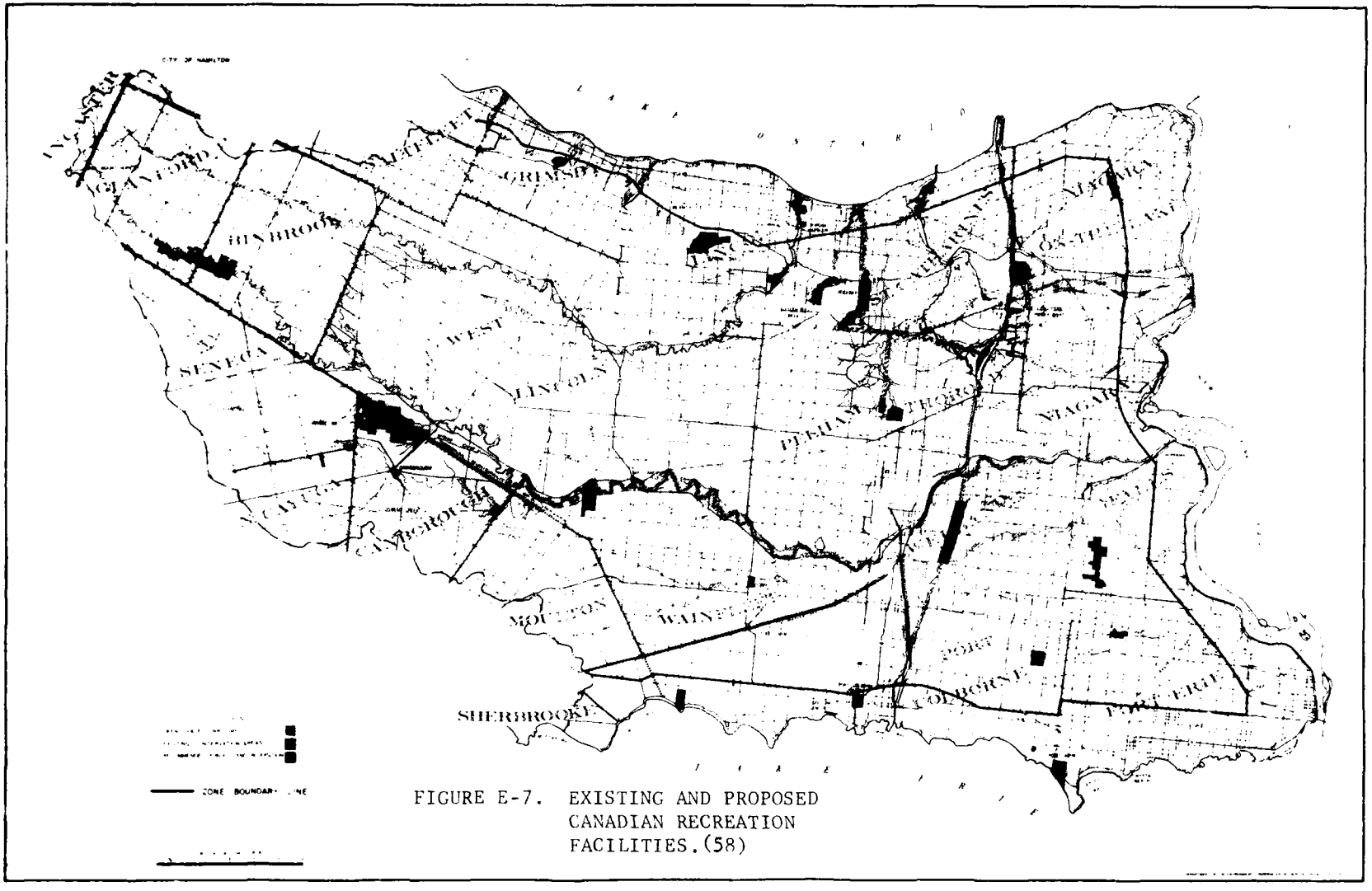


FIGURE E-7. EXISTING AND PROPOSED CANADIAN RECREATION FACILITIES.(58)

TABLE E-23. PARTICIPATION IN SPRING AND SUMMER RECREATION ACTIVITIES[61]

(Percent of All Households)

	Metro Toronto
Swimming	80
Fishing	45
Bowling	36
Power boating	39
Camping/tenting	28
9 or 18 Hole golf	33
Canoeing/rowing	25
Following a nature trail	24
Water-skiing/surfing	26
Golf driving range	23
Badminton	18
Tennis	16
Horseback riding	15
Bird-watching	14
Hunting	8
Miniature golf	13
Sailing	10
Visiting an ethnic festival	6
Skin-diving	5
Archery	4
Lawn bowling	3

TABLE E-24. PARTICIPATION IN WINTER RECREATION ACTIVITIES[61]

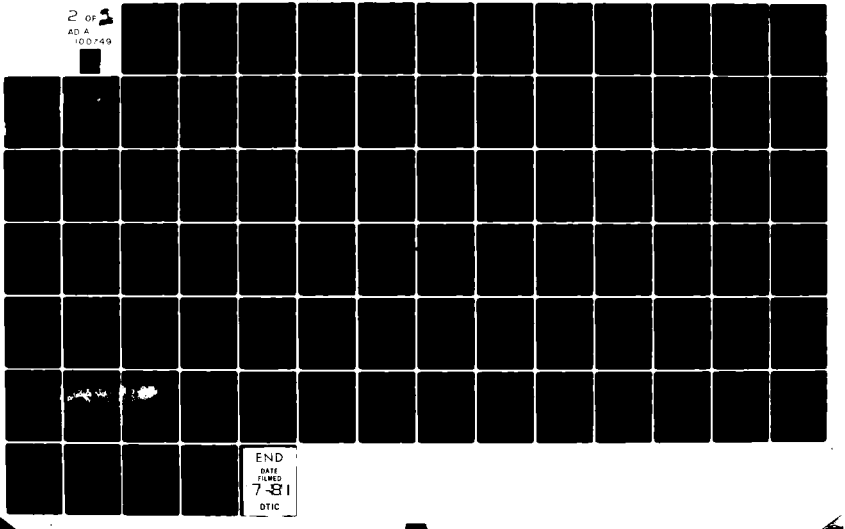
(Percent of All Households)

	Metro Toronto
Ice skating	61
Tobogganing	37
Playing hockey	26
Skiing - at all	19
Skiing - at resort away from city	9
Curling	13
Ice fishing	9
Power sledding	4
Bob-sledding	2
Ice boating	0.1

AD-A100 749 CORPS OF ENGINEERS BUFFALO N Y BUFFALO DISTRICT F/G 13/2
REVIEW OF REPORTS ON LAKE ERIE-LAKE ONTARIO WATERWAY, NEW YORK,--ETC(U)
OCT 73 K M DUKE, J K BAKER, R D BURKETT

UNCLASSIFIED NL

2 OF 2
AD A
100749



END
DATE FILMED
7-81
DTIC

TABLE E-25. DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS IN DIFFERENT RECREATION ACTIVITIES[61]

Recreational Activity	Age of Head of Household	Family Composition - Age of Children	Predominant Educational Level - Head of Household	Predominant Occupation - Head of Household
Camping	41 - 50	Teenagers and/ or > 12 yrs.	Population average	Skilled
Nature trail	31 - 40 41 - 50	< 15 yrs.	High school and university	Professional owner/manager
Fishing	31 - 40 41 - 50	> 12 yrs.	High school and up	Population average
Riding	41 - 50	Teenagers and > 20 yrs.	High school and up	Population average
Sailing	41 - 50	Teenagers	University	Professional
Canoeing/rowing	41 - 50	Teenagers	University	Top white collar
Power boating	41 - 50	< 15 yrs.	High School	Sales, owner/manager
Water skiing	41 - 50	Teenagers	High school and university	Skilled and up
Golfing	41 - 50	--	High school and university	White collar
Driving range	21 - 30	Teenagers	High school	Professional, clerical
Tennis	41 - 50	Teenagers and/ or > 20 yrs.	University	Population average
Bowling	31 - 40 41 - 50	Teenagers and/ or < 12 yrs.	High school and up	Skilled, owner/manager
Snow skiing	41 - 50	Teenagers	University	Professional owner/manager

Population data for the project region are shown in Table E-26.[62,63,64]

TABLE E-26. REGIONAL POPULATION PROJECTIONS[62-64]

	1970	1990
Buffalo zone	462,768	377,050
Developed zone	304,863	304,425
Active fringe zone	386,578	617,010
Moderate growth zone	102,840	132,095
Rural zone	89,905	106,885
U.S. Total	1,346,954	1,537,465
Canadian Water Frontage and Peninsula Interior Zones Combined	368,424	500,000

Buffalo Zone. In 1970, the population of Buffalo was 462,768.[44] With 1,095 acres of community parks, the park land per 1,000 population ratio was 2.4 – considerably below the five acres per 1,000 standard. Since there are no regional parks or corridors in Buffalo itself, the needs of its population, as expressed in the total parks standard of 25 acres per 1,000 must be met, if at all, by facilities in the surrounding region.

Based upon a projected reduction in Buffalo population by the year 1990 to 377,050, the recreation needs will decrease by approximately 20 percent.[63] Projected park additions proposed by the Erie and Niagara Counties Regional Planning Board in parks of 25 acres or more total 50 acres. With this addition and the reduced population, the projected 1990 community park ratio is 3.0 acres per 1,000 population – a continuing deficiency. A comparison of the Ontario activity preference data with existing Buffalo facilities indicates a considerable unmet need for water-oriented facilities (swimming, boating, fishing, hiking, nature study, and camping).

Developed Zone. The 1970 population of the developed zone was 304,863.[44] Community parks in the zone total 1,187 acres, or 3.9 acres per 1,000 population. Regional parks, not including the Robert

Moses Parkway, total 680 acres or 2.2 acres per 1,000 population, as compared to a total regional standard of 20 acres per 1,000. This figure does not adequately present the extent of the regional deficiency, however, since the developed zone park lands are extensively used by tourists.

The 1990 projected population of the developed zone is a nearly constant 304,425 persons. Proposed park acquisitions total 213 acres of community parks and 710 acres of regional parks and corridors. These changes would produce a total of 1,400 acres and 1,390 acres of community and regional parks, respectively, and ratios of 4.6 acres of community parks and 4.6 acres of regional parks per 1,000 population. These figures suggest near-adequate community facilities but do not take account of the heavy tourist use. A severe local deficiency is apparent in regional facilities. Water-based activity needs are, as in Buffalo, in short supply.

Active Fringe Zone. The 1970 Active Fringe Zone population 386,578[44] Community park lands totalled 702 acres, or 1.8 acres per 1,000 population. Regional parks totalled 3,497 acres or 9.0 acres per 1,000, primarily on Grand Island. The projected 1990 zone population is 617,010. Proposed new community park lands total 800 acres, while regional park additions including extensive proposed corridors total approximately 2,880 acres, for totals of 1,502 acres and 6,377 acres, respectively. The resulting ratio for community parks is 2.4 acres per 1,000, or roughly half the 5 acre recommended standard. The regional parks ratio becomes 10.3 acres per 1,000, presenting a continuing deficit in open space and major recreation areas. The proposed new regional facilities, especially the corridors, would be of considerable value in meeting needs for hiking, picnicking, bicycling, and fishing. Serious deficiencies would still exist for swimming, boating, nature study, and camping facilities.

Moderate Growth Zone. The 1970 population of this zone totalled 102,840.[44] Community parks totalled 281 acres, or 2.7 acres per 1,000 population. Regional parks total 2,532 acres or 24.6 acres per 1,000. Projected zone population for 1990 is 132,095 persons. Proposed community park acquisition totals 1,625 acres. Regional additions total 6,167 acres mostly in corridors, do not include a Lake Ontario Parkway. Total community park acreages would then be 1,906; regional total would be 8,699. The community park ratio would

be 14.4 acres per 1,000 population. The regional ratio would be 65.9 acres per 1,000 population.

Rural Zone

The 1970 population of the rural zone was 89,905.[44] Community and regional park lands totalled 94 and 4,156 acres, respectively. The community park ratio was 1.0 acre per 1,000. The regional park ratio was 46.2 acres per 1,000. Projected 1990 population totals 106,885. Additional planned community park lands total 1,225 acres for an overall total of 1,319 and a ratio of 12.3 acres per 1,000 population. Regional park additions total 4,538 acres for an overall total of 8,694 acres or a ratio of 81.3. These figures do not include 10,054 acres of existing reservations and Erie County forests, nor do they include a 6,000-acre proposed addition to the Zoar State Forest. The rural and moderate growth zones, with proposed new acquisitions, will include the bulk of the major regional facilities serving the Erie-Niagara Counties area. Boating and camping facilities will be concentrated in the rural zone.

Summary Demand Analysis – U.S. Zones

The above calculations of recreation demand in terms of standards for areas per 1,000 population do not include considerations of the increased tourist use of recreation facilities in the area. Accurate data are not available but it is estimated that over 5,000,000 visitors travel to the Falls area each year.[12] Since these people are only temporary visitors to the area, their numbers cannot be translated into the population base for determining "parks per 1,000" ratios. The dominance of tourism affects the type of facilities provided as much as overall demand. Thousands of acres of facilities in the Niagara Frontier Parks, included in "regional parks" statistics, are in reality special purpose, tourist-serving facilities. As such, their contribution to resident populations are less significant than gross acreages might indicate. The tourist impact is heaviest on regional park facilities offering special sightseeing attractions, camping, and picnicking facilities. Local park facilities are less affected unless their location or special features make them particularly attractive to tourists.

Another striking feature of recreation in the project area is the considerable disparity between the location of centers of demand from concentrations of facilities. The needs of Buffalo, the developed zone, and the active fringe zone are accommodated primarily in the rural and moderate growth zone and in Canada.

The major area of unmet recreation demand in the region is water-based activities. Marinas are scattered along the Lake Erie and Lake Ontario shores. Public swimming facilities are available only on Grand Island, along the Canadian Lake Erie shore, and at a few community swimming pools. Other currently inadequately met areas of demand (including camping, hiking, bicycling, and nature study) would be better served if proposed new acquisitions are made. The numerous stream corridors proposed by the Erie and Niagara Counties Regional Planning Board are especially critical.[48] All calculations for 1990 projected acres per 1,000 population have assumed total completion of the recommended acquisitions and development. To the extent that reality falls short of this ideal, regional recreation deficiencies will be increased. If no new acquisitions were made, for example, the current total of 14,224 acres of park lands would produce a 1990 ratio of 9.3 acres per 1,000 population - far short of the recommended standard of 25 acres per 1,000.

Canadian Water Frontage and Peninsula Interior Zones

Recreation demand for the Canadian facilities comes from three sources. The most immediate, the resident population on the Niagara peninsula, totalled 368,424 in 1970. The regional resident population within 1 hour's driving time comprises a second source of recreation demand. A 1971 study indicated the total size of this population, using Effingham as a geographical center, was 1,993,000.[61] The third and largest demand source is the nonresident tourist population drawn to the area. A survey conducted in 1969 indicated a total of 13,709,000 visitors came to the Niagara-Iroquois area (including Hamilton) during the summer months.[65] According to local officials, approximately 75 percent of these visits were to the area roughly bounded by the Niagara River and the Welland Canal. Approximately 51 percent of these visitors (5,234,000) to the Welland-Niagara area were of U.S. origin.[65]

Use data from the Canadian facilities indicates two significant trends. Foremost is the preponderance of users of U.S. origin - either tourists or Buffalo area residents. A spot check of the parking area at Sherkston, a popular privately owned recreation site on Lake Erie within 30 minutes of Buffalo, indicated 94 percent of the cars bore U.S. license plates.[61] Similarly, 1970 data on the Niagara River sites showed visitors from the United States represented 50 to 67 percent of all users.[61]

A second potentially significant trend is an apparent tapering off or even reduction of visitors to some heavily used facilities. Long

Beach Conservation Area on Lake Erie, for example, experienced successive declines in use from a high of 132,000 in 1969 to 104,000 in 1970, to 80,000 in 1971.[61] One plausible explanation for the decline may be "user dissatisfaction with capacity use conditions".[61] Most facilities in the interior zone, serving primarily local users, still exhibit use increases.

E-59 Secondary Effects of Recreation Activities

In addition to direct effects on the overall levels of recreation supply and demand in the project region, the proposed 1970–1990 new recreation facilities and other major developmental activities in the area could be expected to produce several secondary or indirect effects. Three potentially significant types are discussed below. Since these effects are anticipated to be of primary importance to specific subsections of the project region, no attempt has been made to estimate regional baseline projections.

Local Employment in Recreation and Allied Services

As a result of development of these new facilities, service related jobs will be created. These jobs will include both direct involvement with operating new onsite facilities and supportive, service activities such as motels, eating places, and private campgrounds.

Recreation Use Attracted From Other Facilities

In addition to attracting new users, either local or tourist, new facilities can be expected to draw recreationists who would go elsewhere in the absence of new facilities. Four particular possibilities for such displacement appear likely.

- Some users of Canadian areas may be attracted to the region. A survey conducted in 1970 indicated that over 70 percent of those interviewed at the Welland Canal observation area at Lock 3, St. Catharines, and at Charles Daley Park, St. Catharines, were of U.S. origin.[65] The average length of stay in the St. Catharines region was between 1/2 and 1 day. Over 70 percent were visiting the area for the first

time. Present use of the only major recreation site along the canal, Lock 3 in St. Catharines, is variously estimated at 1 to 1.5 million visitors annually.[65] It is likely that a significant portion of this tourist population would visit new facilities on the American side.

- Much water-based recreation engaged in by Buffalo area residents currently takes place along the Lake Erie (especially the Canadian portion) and Lake Ontario shores. If new facilities provided boating, swimming, or fishing facilities, a certain amount of lakeshore use would be displaced to the inland area due to more convenient access.

- Most of the project region's camping takes place in Canada. If camping facilities were built in conjunction with new facilities, some of that camping use, particularly by tourists, could be expected to occur at these facilities.

- If visitors are attracted to the region from other areas for recreation and sightseeing purposes, their associated expenditures will also be transferred. In 1970, the 13,709,000 visitors to the Canadian Niagara peninsula spent $158,000,000 in related expenditures.[65] Corresponding portions of such expenditures would occur in the immediate project area.

New Tourist Expenditures

Construction of new recreation facilities might attract a number of new tourists to the immediate area or lengthen the stay of visitors attracted by other primary purposes. These new visitors will provide new income to the area. As discussed above, much of this income will be displaced from other areas in the broader region.

Demand Projections for 1990–2030. Any attempt to foresee the future 60 years hence amounts to little more than reading tea leaves. Nevertheless, one can perhaps identify several "alternative futures" that may describe the state of recreation supply and demand in the project region between 1990 and 2030. Table E-27 illustrates the implications of possible alternative population and demand patterns. This table assumes a gradually increasing per capita demand for recreation, based on increases in disposable income and leisure time. The unpredictable impacts of new demand preference patterns are included to emphasize the tenuous nature of any long-range projections.

TABLE E-27. ALTERNATIVE RECREATION SCENARIOS, 1990-2030

Population Changes	Demand	
	1972 Preference Patterns	New Preference Patterns
Incremental growth at projected 1995-2000 rates	Demand increase at rate greater than population increase, local parks supply inadequate if no more additions	?
Accelerated growth	Very rapid demand increase, all park types inadequate	?
Stabilization with increased concentration	Local park supply inadequate, regional facilities nearly adequate	?
Stabilization with increased dispersion	Both local and regional facilities near adequate	?
Population decreases	All facilities adequate	?

E-60 Aesthetics

Aesthetic impacts associated with environmental alterations can be evaluated by considering the overall composition of the environment as well as the elements that define this composition. These elements include land, water, air, man-made objects, and biota. Aesthetic qualities in the proposed LE-LO Waterway project area are delineated by these six components included in this section.

Relief and topographic character are the primary aspects of the land component. The area of the proposed Waterway can be characterized as flat to very gently sloping with the east-west Niagara Escarpment providing the only area of dramatic relief. At the Escarpment, the land elevation drops sharply in two steps of 80 and 150 feet, respectively. No prominent north-south tending landscape features are in the immediate Waterway route area except for the river course.

The visual quality of the air is generally good with the exception of occasional periods of fog below the Escarpment and visible pollution in the North Tonawanda area. Occasional disagreeable odor patterns are uncommon except in the highly industrialized strip bordering the Niagara River. However, occasional air pollution plumes from the industrialized river area affect the route area, depending upon local meteorological constructions. High, unpleasant noise levels are also confined to the industrialized strip and the flight paths of the local military and commercial jet port facilities.

Important aesthetic features of the water environment include the character of the land-water interface along the Niagara River and Lake Ontario shore and the appearance and odor of these water bodies. The Niagara River interface is abrupt and unattractive, dominated by man-made features (industries, reservoirs, bridges). The water appearance is moderately turbid, though occasionally roiling in rapids areas, with some evidence of oil and floating material from nearby industrial activities. The Lake Ontario land-water interface, in contrast, is a narrow strip of active natural erosion with elevation changes of 5 feet or less. Odor and floating debris are generally unobtrusive.

Biotic contributions to area aesthetics are limited to the patterned diversity of natural areas, agricultural lands and vineyards, common farm stock, and occasional wildlife – mainly deer, upland gamebirds, and waterfowl.

Man-made structures dominate the Niagara River area. The remainder of the proposed Waterway route is marked by scattered farm buildings and single family dwellings.

The composite effect of the immediate proposed route environment is largely one of a moderately pleasing pastoral setting without unusual or rare features other than the drama of the Escarpment. The stark industrializing of the Niagara River frontage area stands in marked contrast to this general pattern.

It is anticipated that by 1985, incremental changes will have occurred along the proposed route. Primarily, there will be a moderately increased conversion rate of agricultural to residential and recreation land uses along the Lake Ontario shore and Bond Lake Park areas. However, no major alterations are anticipated in the aesthetic baseline.

ASSESSMENT OF ENVIRONMENTAL IMPACTS

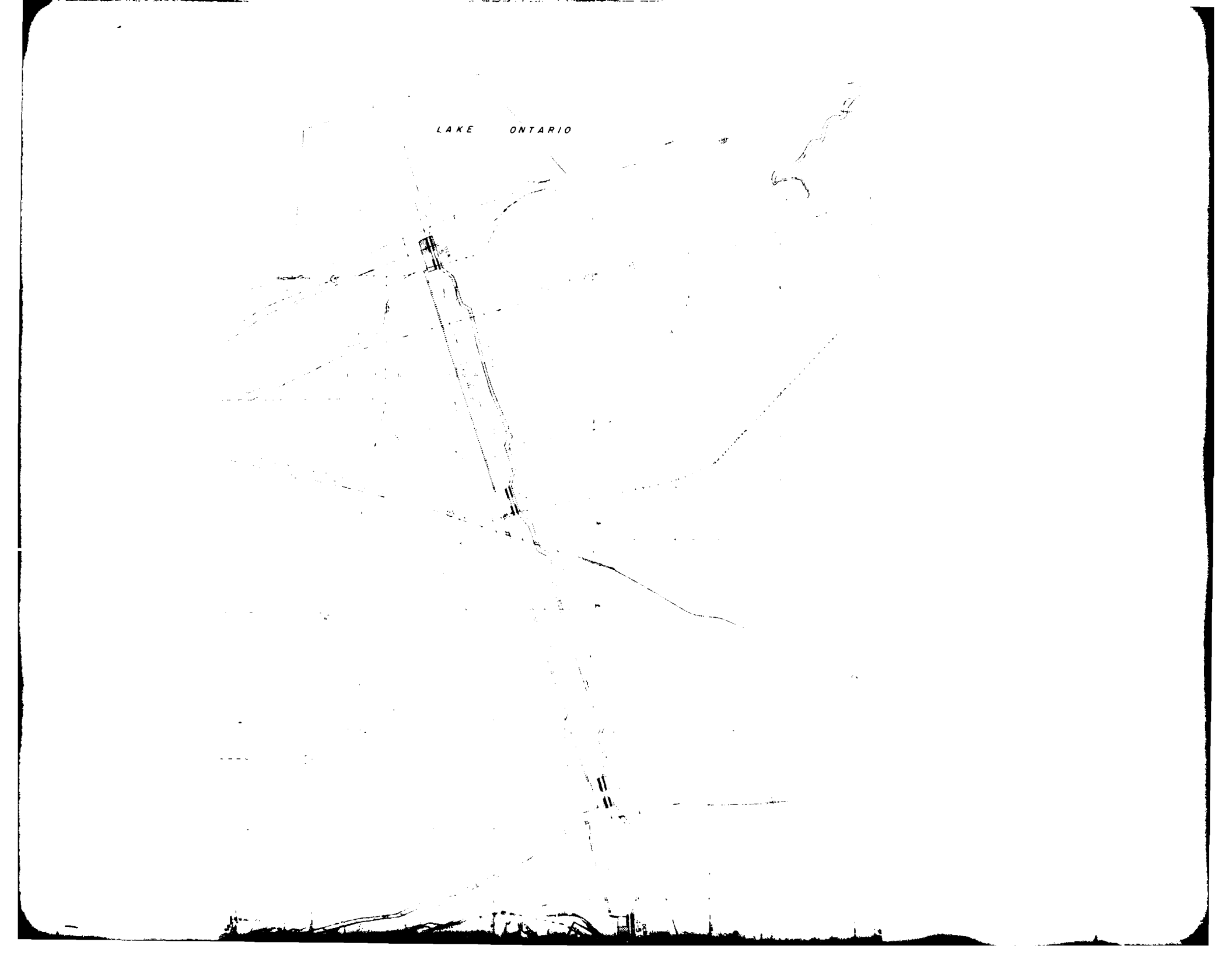
E-61 Introduction

This Section assesses the changes in the 1980-2030 baseline conditions, as described in the Assessment of Baseline Conditions, of Erie and Niagara Counties due to the construction and operation of the LE-LO Waterway. The assessment procedure consists of superimposing the design, management, and operation of the canal project on the projected baseline environment and then predicting and evaluating the resulting changes. Such changes may be beneficial or harmful to the environment. While numerous changes result from a project of this magnitude, only those impacts judged significant are discussed in detail.

The route of the proposed LE-LO Waterway is shown in Figure E-8. Total length is about 31.5 miles with 16.5 miles overland and 15 miles of river channel. The river channel varies from 400 to 700 feet in width along the straight segments with a wider channel provided at the turning points where two segments connect. One lock would be located on Squaw Island.

The overland route consists of two sections. The first section, south of the Niagara Escarpment, will be cut below the natural surface of the terrain. Average width will be about 750 feet. Water level in the canal will average 30-35 feet. The six highway and railway linkages proposed to cross the canal in this section will require suspension bridges. The second section, which is north of the Escarpment, will be above the surface of the terrain and will require dikes. Average width of the Waterway in this section, inclusive of dikes and surge basins, will be about 1750 feet. Water depth will vary from a minimum of 30 feet to a maximum of about 100 feet (see Plate C-22 of Appendix C). A temporary construction zone will be required outside this width. Four locks located in this section permit the necessary 320-foot change in grade to be made in four equal increments. A breakwater will be constructed in Lake Ontario. The area enclosed by the breakwater will be 1650 acres. The dikes will be of stone and rubble extending about 15 feet above the mean lake water level. The minimum depth beyond the guidewalls of Lock 1-5 will be 30 feet. The three proposed railway and highway crossings of the segment of the canal will be tunnels under the locks.

Construction of the project, expected to begin in the mid-to-late 1980's, will require 5 to 7 years.


LAKE ONTARIO

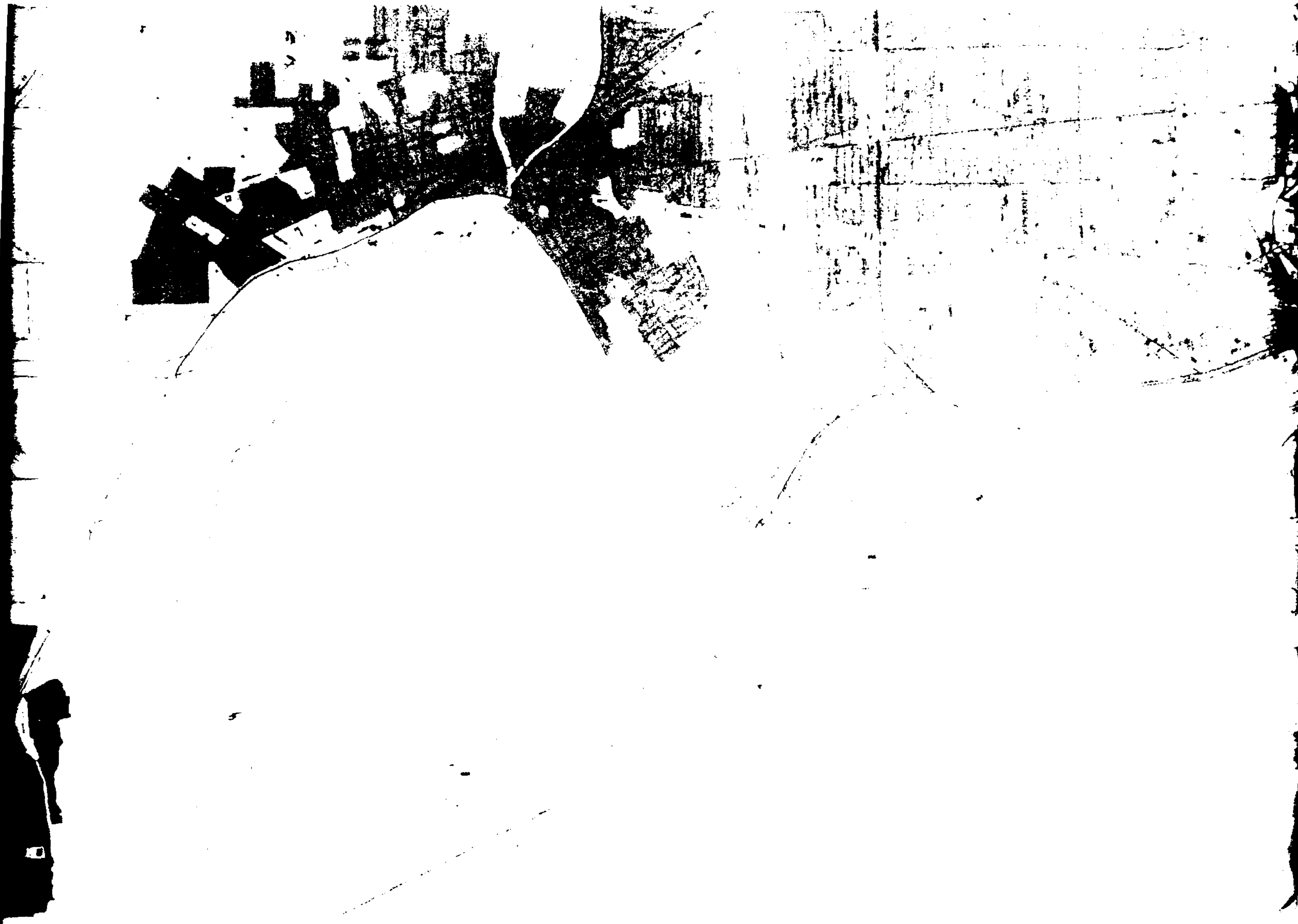


FIGURE E-8. ROUTE OF THE PROPOSED LE-LO WATERWAY

The same hierarchical system used in the baseline environment assessment (see Figure E-3) is used here to organize and evaluate the predicted impacts. Note that these potential impacts are likely to take place only if the baseline projections are accurate and the Waterway design is not altered. Because changes (impossible to predict at this time) in both the projected baseline conditions and the design of the Waterway are certain to take place before construction begins, an environmental impact statement will be prepared prior to the initiation of construction to evaluate the changes in impacts resulting from these alterations. However, the general types of impacts described here are those that would be incurred by any canal project of this magnitude. Unforeseen changes in the baseline environments and environmental legislation or in the project design could result in appreciably different kinds of impacts.

E-62 Physical and Chemical Environment

E-63 Land

Major cut requirements for construction of the proposed gravity-flow canal would generally be in the overland section south of the Niagara Escarpment; the areas requiring fill are north of the Escarpment. It is presently expected that excavated materials south of the Escarpment could be fully utilized in construction of dikes on the Ontario plain, north of the Escarpment. It is further assumed that physical alterations, except the transportation corridor relocations, to the land environment would be within the boundaries shown on Figure E-8.

E-64 Physiography

Completion of the project would require excavation of overburden and subsurface geology across the Huron Plain from the Niagara River to the Escarpment, a distance of about 8 miles. The total cut would average less than 750 feet in width with the maximum depth about 100 feet at the Escarpment. Preempted acreage on the Huron Plain would total about 1.3 square miles exclusive of land required for the relocated highways and railways. The excavated walls along the canal route would be essentially continuous and straight-sided with exception of contouring of surface soils and ledges in the section where the East and West Canal Roads are located.

The construction dikes north of the Escarpment on the Ontario Plain would rise from the existing land forms at a ratio of 2 or 3. Average width of the 8.5 mile traverse would exceed 1750 feet, inclusive of surge basins and exterior diking toes. For the finished Waterway, the construction corridors, the lay down areas, and the land required on the Ontario Plain would total about 4.5 square miles exclusive of land for transportation relocation. The maximum elevation changes from the top of the dikes to the surrounding land forms would be about 100 feet.

Minor surface drainage features discharging directly to the Niagara River and to Lake Ontario within the project area would be completely eliminated. Bergholtz and the Twelvemile Creeks subbasins would be severed. Present plans indicate that the head waters from Bergholtz Creek subbasin would be discharged directly into the proposed canal and those from Twelvemile Creek subbasin would be rerouted to Sixmile Creek.

South of the Escarpment, suspension bridges would accomodate continuing traffic flow over the canal. North of the Escarpment, in the diked zone, continuance would be allowed through tunnels. In redeveloping existing routes south of the Escarpment, five highway suspension bridges are planned for existing routes. The grade change produces suspension bridges ranging in length (including the approach) from 0.4 to 0.6 mile from the centerline of the traversed canal. The first three roads – Mountain, Saunders-Settlement, and Lockport – would maintain existing centerline. Two roads crossing the planned waterway from the south – Niagara Falls Boulevard and Buffalo River Road – would require realignment. The two affected railroad lines, New York Central and the Erie Lackawanna Central, would be gathered into a common point and cross just south of Lockport Road (see Figure E-8). Grade changes for this railroad bridge will require some 1-3/4 miles along the relocated right-of-way; at least two tunnels and one bridge will be required to avoid interference with traffic on primary routes crossed outside of the expected Waterway construction zone. Several small residential communities will be affected during construction and by trains operating on these relocated routes. A sixth highway suspension bridge near the River Road bridge will be required if the proposed LaSalle Expressway Section II – Belt Expressway Section I is built.

Transportation routes north of the Escarpment would continue through proposed tunnels under the narrow lock zones (see Figure E-8). Route 18 and Youngstown Road are gathered and would pass under Lockface 1-5 using a single tunnel. Route 93 and the New York Central Railroad line to the north would cross under the south facing of the

Lock 2-5 while U. S. Highway 104 will cross under the south face of Lock 3-5 just below the Escarpment. These transportation networks should enter and leave these tunnels approximately at the grade of the existing land surface.

It is difficult to hypothesize impacts of major significance from traffic disturbance during construction or from planned discontinuance of minor service networks after construction. Inconvenience to users during the construction period will depend primarily on development scheduling. Existing routes crossing the Waterway will not be closed until the bridge or tunnel designed to carry the traffic currently using that road is ready for use. Such practice can be expected to minimize required disruptions to traffic patterns. With exception of a possible imbalance in networks north of the Escarpment (considered to be of minor importance), planned relocation of transportation routes should suffice for the immediate postconstruction period. It is assumed that the width of bridges and tunnels will be appropriate to handle the anticipated traffic.

E-65 Soils

Selective use of overburden during construction is anticipated. Materials of particular interest are those suitable as the impervious core for the proposed dikes traversing the Ontario Plain. Soils that presently appear to be most suitable for this use are located on the lowlands of the Huron Plain. Sufficient quantities of these high-percentage clay soils are assumed to be present within cut zones south of the Escarpment; thus, no additional borrow areas are presently anticipated.

E-66 Geology

With respect to both seepage and loading, the geology of the area can be considered quite competent. Changes in geological structure due to this project would be those associated with relocation of excavated bedrock from within the required cut traverse, yet alterations would be contained within the construction zones. Required **blasting, crushing,** and haulage would, however, influence **air environment and surface drainage systems.**

E-67 Water Environment

E-68 Stream Flow Variations

The severance of Bergholtz and the Twelvemile Creek subbasins by the LE-LO Waterway will cause a seasonal reduction in discharge of 41 and 39 percent, respectively. Impacts due to reduced flows in

the Twelvemile subbasin are not expected to be significant. However, with present and projected waste loadings to lower reaches of the Cayuga-Bergholtz subbasins, the removal of 13 square miles of contributing drainage area would further reduce this system's natural assimilating capacity.

Maximum diversions through the proposed LE-LO Waterway could approach 4.3 percent (8800 cfs) of the average Niagara flow (approximately 202,000 cfs). However, a yearly average of 1.1 percent (2,200 cfs, see Table C-13 of Appendix C) may be anticipated. Since no consumptive loss in the water in the Waterway would occur, impacts associated with planned diversion could influence only the diversions for the hydroelectric projects or Niagara Falls downstream from the waterway inlet. Flow rates over the falls are controlled by international agreements, and reductions in the river flow by the Waterway will not violate these agreements.

E-69 Groundwater Hydrology

Final design of the proposed LE-LO Waterway can be expected to cause little alteration to the groundwater resources of the region. South of the Escarpment, the direction of groundwater flows would be toward the deep cut of the Waterway. One area of concern, the highly fertile muck soils located between Sanders Settlement and Upper Mountain Roads, would be influenced negatively. An uncontrollable decrease in groundwater levels within those muck soils can be expected to contribute to a long-term reduction in agricultural productivity.

North of the Escarpment, the potential exists for seepage from the Waterway to the groundwater systems. Design procedures can be expected to significantly reduce impacts associated with aquifer level and flow-direction changes. Significant reduction in water quality is not anticipated.

E-70 Temperature

No major temperature changes from normal are expected within affected Bergholtz and Twelvemile subbasins. Slight increases in the water temperature of the discharge to the nearshore waters of Lake Ontario are anticipated. With respect to worst-case water temperature, the Waterway would be expected to respond as a standing water body. Characteristic of other similar region waters, during the warmest months (July and August), water temperature would not be

expected to exceed 82 F, about 9 F above the ambient surface water temperature of Lake Ontario. Such increases are not expected to significantly influence the aquatic environment.

E-71 pH

The normal pH range in the two subbasins affected by the proposed project are expected to be unaltered. The pH of shore zone waters of Lake Ontario, which ranges from 6.7 to 8.5, is not expected to be affected by the canal discharge unless the quality of water entering the canal, influenced especially by the quality of the Tonawanda and Ellicott Creeks discharges, is poor.

E-72 Turbidity and Total Dissolved Solids

During the construction period, two major physical alterations to the aquatic environment would be (1) increased sediments in surface runoff due to construction procedures north of the Escarpment and (2) resuspension of river sediments associated with underwater excavation work. Although careful planning can be expected to reduce potential impacts, possible worst-case occurrences during the 6-year construction period could result in major deleterious alterations of the aquatic environment due to erosion and the resulting increased turbidity. Areas of concern with respect to surface runoff are the lower Twelvemile Creek subbasin and shore-zone waters of Lake Ontario to the east from the proposed Waterway outlet. Transported sediments can be expected to redeposit in backwater zones of lower Twelvemile Creek adjacent to the community of Roosevelt Beach.

In most reaches of the proposed surface water route, excavation works and dredging are expected to cause insignificant alterations to the aquatic environment. However, dredging along nearshore areas at the Niagara River may present major problems when associated highly polluted sediments are resuspended. Required dredging work within Lake Ontario will cause a short-term turbidity increase in the nearshore waters. As resuspended sediments are not expected to be polluted, associated chemical alterations would seem insignificant.

E-73 Dissolved Oxygen

Dissolved oxygen fluctuations within the Twelvemile subbasin are not expected to be altered. Reduction in dilution flows through the Bergholtz subbasin will result in a lowering of dissolved oxygen value. Turbulence of water caused by the operation of the locks could result in

an increase in dissolved oxygen content in the Waterway. On occasion, the concentration of dissolved oxygen of discharged waters to the shore zone of Lake Ontario may decline to below 2 mg/l.

E-74 Fecal Coliforms

The fecal coliform content of the water discharged to Lake Ontario from the Waterway is expected to be lower than that of the water withdrawn from the Niagara River due to die off of coliforms during their passage through the Waterway to Lake Ontario. No discharges containing significant quantities of coliforms are expected into the Waterway.

Concentration of fecal coliforms within the Twelvemile Creek subbasin should not be affected. Changes are expected in lower Bergholtz Creek where concentration will increase due to a reduction in water flow (but not sewage discharge) caused by the cutting off of 13 square miles of the drainage basin.

E-75 Toxic Substances

During construction, quantities of diesel fuel, hydraulic fluid, and other toxic chemicals used in equipment or in construction materials or practices may leak into the various creeks draining the Waterway zone. While quantities of these substances are expected to be small, some degradation in water quality in these creeks and in the water bodies (the Niagara River and Lake Ontario) should be anticipated on receiving these discharges.

During operation of the Waterway, toxic substances could be discharged into Lake Ontario. The quality of the Waterway waters is influenced by the kinds and amounts of chemicals released from ships and boats using the canal. Regulations governing such discharges are expected to minimize the concentrations of toxic substances in the Waterway. Another important factor influencing the concentration of toxic substances released to Lake Ontario is the quality of the water entering from the Niagara River. Worst-case quality of the Niagara River waters would be expected to correspond directly with quality of the waters discharged from Tonawanda-Ellicott Creeks subbasin. Flushing action of spring runoff would transport toxic substances along the eastern shore zone of the Niagara River and into the proposed Waterway. Under worst-case situations, Waterway discharge values exceeding 1 ppb phenols and 0.3 ppm iron may be anticipated.[11, 12] This impact will not be realized if pollution-control programs succeed in significantly improving the water quality of Tonawanda and Ellicott Creeks.

While concentrations within the Twelvemile Creek subbasin are expected to be unaltered, volumetric ratios of lower Cayuga-Bergholtz Creeks subbasin would increase due to reduction of dilutant headwater inflows.

E-76 Inorganic Nutrients

The water quality in regard to inorganic nutrients of the waters discharged from the Waterway to Lake Ontario would be expected to be similar to inflow quality. The inputs of inorganic nutrients along the overland route are expected to be small.

Operational impacts on Bergholtz and Twelvemile Creeks subbasins would be due to removal of contributing drainage area. Generally, the Twelvemile Creek subbasin receives uniformly, nonpoint-source agricultural pollutants, resulting from runoff; thus, removal of upland drainage is not expected to alter the chemical quality of the waters of this subbasin. On the other hand, Cayuga-Bergholtz Creeks subbasin receives significant point-source inputs of contaminants. The reduction of dilution inflow can be expected to negatively alter the downstream water quality.

E-77 Air

Alterations to the air environment during construction can be expected to be major. Predominant emissions would be dust generated by excavation and handling procedures. The combustion products emitted from construction equipment may be considered as minor in comparison with noise emissions from construction operations (e.g., blasting, heavy equipment, and rock-crushing operations).

Increased concentrations of air pollutants during operation of the proposed LE-LO Waterway would be almost exclusively due to emissions from vessels using the Waterway. Along the overland route north of the Escarpment, deleterious alterations of the ambient air quality are not expected to be a problem. However, in certain areas south of the Escarpment, near Niagara Falls and along the water route near the Buffalo and Tonawanda areas, emission of combustion products may result in increased degradation of the projected air environment.

Projected air pollutants and associated affected areas of continuing concern in the Niagara Frontier are discussed in Paragraph E 20. Assuming present air-pollution-abatement trends continue and appropriate emission-control devices are required on all ships and boats,

transient vessel emissions along the LE-LO Waterway can be expected, with few exceptions, to produce insignificant alterations in the air environment. Further, significance of increased concentrations of air pollutants due to operation emissions within areas projected to be in violation of Federal standards would be essentially indefinable.

Note that the judgment "no significant increase in the regional concentrations of air pollutants due to LE-LO Waterway operation" is based on the following assumptions: (1) the canal is essentially a line of source of emissions, and (2) source and wind characteristics will prevent emissions from remaining in the immediate area. Under worst-case conditions of a queue of vessels backed up waiting to pass through the canal and stagnant atmospheric conditions, local build up of air pollutants can be expected. The severity of the problem is completely dependent on the duration of the delay, the severity of the stagnation, and the ambient air quality.

For the purpose of completeness, estimated total emissions during operation are included. It was assumed that 2000 vessels per year would pass through the Waterway, all would be powered by diesel fuel, or No. 6 fuel oil, and the route is approximately 32 miles and 8.5 months would be the annual operation period. The calculations are based on existing data on the emissions from essentially unregulated vessels and should represent the worst-case situation (Table E-28). It is expected that the installation of effective emission-control devices will be required for ships before the Waterway becomes operational. This would significantly reduce the emissions cited in the following sections.

E-78 Sulfur Dioxide

Vessels under way powered by fuel oils or diesel fuel can be expected to emit 7.1 S and 2.05 pounds per mile sulfur oxides, respectively (S – percent weight sulfur in fuel). During the yearly operation period of the LE-LO Waterway, total emissions along the route of sulfur dioxide can be expected to range between 0.19 and 5.7 tons.

E-79 Nitrogen Oxides

Vessels under way powered by fuel oils or diesel fuel can be expected to add to the ambient air of the Niagara Frontier 4.6 and 1.0 pounds per mile nitrogen oxides, respectively. Total yearly operation emissions of nitrogen oxides along the route of the LE-LO Waterway can be expected to range between 32 and 147.2 tons.

TABLE E-28. CONCENTRATION AND TOTAL AMOUNTS OF POLLUTANTS EMITTED BY THE 2000 VESSELS USING THE LE-LO WATERWAY.

(Based on Data for Diesel Engines Lacking Emission-Control Devices)

Pollutant	Total Annual Emissions, tons	1 Hr Max, $\mu g/m^3$	24 Hr Max, $\mu g/m^3$	Yr Average, $\mu g/m^3$
SO_2	5.6	0.08	0.04	0.003
Particulates, low	12.8	0.19	0.10	0.008
high	48.0	0.70	0.35	0.028
NO_2, low	32.0	0.47	0.24	0.019
high	147.2	2.20	1.10	0.089
HC , low	6.4	0.10	0.05	0.004
high	22.4	0.33	0.17	0.014
CO , low	0.064	-	-	-
high	28.8	0.43	0.22	0.018

E-80 Particulates

Emissions of particulates from vessels powered by fuel oil or diesel oil combustion averages 0.4 and 1.5 pounds per mile, respectively. Increases of particulates to the ambient air along the proposed LE-LO Waterway can be expected to range between 12.8 and 48 tons during the yearly operation period.

Fugitive dust during construction is expected to contribute significantly to regional particulate levels. This dust will arise from blasting, rock crushing, and the movement of heavy equipment. The actual magnitude of this impact can be better described at the time more detailed construction procedures are developed.

E-81 Hydrocarbons

Contributions of hydrocarbons to the air environment from vessels traversing the proposed LE-LO Waterway would average 0.2 or 0.7 pounds per mile (powered by fuel oil and diesel fuel, respectively). Total emissions of the hydrocarbons during yearly operation can be expected to range between 6.4 and 22.4 tons.

E-82 Carbon Monoxide

Values of 0.002 and 0.9 pounds of carbon monoxide per mile are considered representative for vessels powered by fuel oils and diesel oil, respectively. Total contributions to the ambient air of the Niagara Frontier can be expected to range between 0.064 and 29 tons during the yearly operation period.

E-83 Noise

Two basic sources of noise are associated with the proposed LE-LO Waterway project. The first source is direct, resulting from the construction and operation of the Waterway itself. The blasting required for the overland cuts south of the Niagara Escarpment and for the river channel is probably the loudest direct noise source. Buffalo, Tonawanda, North Tonawanda, St. Johnsburg, Bergholtz, the area between the Niagara River and Bergholtz that will be urbanized by 1990, Sanborn, Pekin, and several schools are major sensitive areas south of the Escarpment and along the river channel. These will suffer impacts from blasting during construction. Also during construction, almost continuous noise will rise from vehicle traffic, compressors, and other equipment. Less noise is expected from the operation of the Waterway. The engines powering ships are the primary source. Generally, large ocean-going ships have their engines well enclosed and produce little noise at low speeds. Smaller vessels, such as those pushing barges, or pleasure craft with more exposed engines, produce higher levels. As the Waterway is below the surface of the natural terrain south of the Escarpment, the level of noise near the canal resulting from the ship passage will be reduced.

The construction noise will also impact wildlife near the Waterway probably temporarily displacing biota from zones of high noise. The low noise level resulting from the operation of the canal should have little effect on wildlife.

Construction noise will negatively influence recreation, especially at Bond Lake and to a lesser extent the proposed town park on Sixmile Creek, bordering Lake Ontario and other parks near the canal route. Noise from operations should have minor impacts on Bond Lake due to its proximity to Lock 4-5.

The second major noise source is indirect, resulting from traffic on the rerouted railways and highways. Railway noise will result primarily from elevating the railways above grade, thus improving

conditions for noise propagation from rerouting lines closer to sensitive residential areas. These indirect effects of noise will be greatest south of the Escarpment where most of the communities near the Waterway are located. Bergholtz is located near the major indirect noise source, the heavily travelled elevated Penn Central-Erie Lackawanna lines. The impact incurred here is difficult to evaluate. The existing lines pass just to the west of Bergholtz at ground level. The proposed elevated lines while increasing noise propagation, will be located a greater distance from the town. The resulting noise levels at Bergholtz may not be significantly different from those without the project. However, the rerouted line as it swings to the south will significantly increase noise levels in suburban communities such as St. Johnsburg, to the east of the Waterway. The Penn Central line passing through Ransomville, north of the Escarpment, will be tunneled under the Waterway and should not affect the ambient noise levels in Ransomville. The line is little used at present.

Increased noise levels are expected at the highway bridges and tunnels crossing the Waterway. Traffic will be increased due to the funneling of vehicles formerly using 18 routes into 8 bridges and tunnels. However, traffic and thus, noise levels, should be lower on the 10 routes that will deadend at the Waterway.

E-84 Ecological Environment

E-85 Terrestrial Ecosystems

E-86 Natural Vegetation

As a result of extensive agricultural land in Niagara County, the remaining natural vegetation is concentrated in two main locations – the Tuscarora Indian Reservation and the steep slopes of the Niagara Escarpment. The LE-LO Waterway, as presently sited, will have no direct physical effect on the Indian reservation. Location of the Escarpment transection minimizes removal of natural vegetation by following an existing roadway and crossing at a point of relatively low relief which has already met with considerable disturbance by man. Isolated small and moderate sized woodlots along the route will be cleared during construction, particularly north of the Escarpment and in the area immediately south on the crest of the Escarpment near Bond Lake.

All impacts to the natural vegetation will occur during construction phases as a result of direct removal for construction or for borrow material acquisition. No measurable impacts would be expected following the construction phase as no further disruption is anticipated. Of the more than 4000 acres of land which will be directly disturbed by the Waterway itself, about 1000 acres or approximately 25 percent is presently covered with natural vegetation. This includes old fields, shrub areas, forested areas, and wooded wetlands. An additional 203 acres of natural habitat will be required for new road and bridge rights-of-way resulting from the construction of the canal. Areas considered to be sites of future urbanization were excluded from calculations. Thus, these acreages indicate the loss of acreage specifically attributable to the Waterway and new road and bridge rights-of-way.

With respect to the overall health and productivity of the natural vegetation along the canal, loss of this much acreage is not judged to be significant. This statement assumes the maintenance of available habitat within the Tuscarora Indian Reservation and along the Niagara Escarpment and does allow for projected increase in urbanization within the canal area.

E-87 Crops

For purposes of projection and prediction, it is assumed that agricultural practices within Niagara County will remain similar to the present. The factor of slowly but steadily declining available acreage due to urbanization is included.

The Waterway will directly remove approximately 2800 acres of agricultural land from production along its route. This comprises approximately 70 percent of the total land within the Waterway strip proper. An additional 622 acres of agricultural land consisting of about 92 percent cropland and cropland pasture and 8 percent orchards will be needed for road, bridge, or utility rights-of-way.

To assess the nature of the loss of this land to the agricultural productivity of the county, it is necessary to look at the crops produced along this corridor. South of the Escarpment along the Huron Plains, the land is predominantly in pasture with some grain production. Along the ridge of the Escarpment, orchard and vineyards are common on favorable soil types. Immediately north of the Niagara Escarpment, vineyards occupy most of the favorable soils. The Lake Ontario shore is an area of concentration of apple orchards. The muck soils near Sanborn, which are highly productive when planted in certain vegetable crops under artificial drainage, are presently within the Waterway

alignment and would be removed from production. This represents approximately 250-300 acres. Correspondingly within this alignment are approximately 175 acres of vineyards and 135 acres of orchards which would be removed from production.

Impacts to agricultural productivity are expected to be insignificant with respect to pasture, hay, and grain production. Loss of available land for orchards and vineyards is more important to the region. However, the acreages involved, approximately 2 percent of the land in fruit production in the county, do not appear excessive with respect to fruit production, as it is practiced at this time.

The largest loss to agricultural productivity resulting from the Waterway will be the removal of the muck soils area. This is the largest area of its type in production in the region and by far the largest in Niagara County. Production of celery, potatoes, onions and several other vegetable crops for local and regional markets would be significantly reduced by this loss. Local realignment of the Waterway offers some ameliorative potential. Feasibility and resulting environmental implications are discussed in the final section of this report, Environmental and Recreational Plan.

E-88 Dominant Herbivores

Any change in the number of dominant herbivores (white-tailed deer, cattle, sheep, and horses) or the ability of the land to support the population may result in a significant impact upon the health and stability of the environment. The expected impact (possible reduction in numbers) upon this group would result primarily from a direct loss or an alteration of the quantity or quality of the habitats currently used by these browsers and grazers.

The white-tailed deer are known to prefer the "marginal" or "edge" areas associated with forestland, wooded wetlands, and bushy areas where abundant growths of low forage are readily available. It is estimated that the construction of the proposed canal would result in the loss of about 330 acres of forestland, 2 acres of wooded wetlands, and some 700 acres of brush cover. Thus, the deer presently utilizing this area would be displaced and forced to relocate within similar habitats throughout their range. Since few data are available regarding present population levels, distribution, movements, etc., of deer in this portion of New York State, the potential impacts are best considered qualitatively. Although the white-tailed deer's normal home range is on the order of a 1 mile radius,[24] they are quite capable of migrating relatively large distances

to seek sufficient amounts of preferred habitat. Thus, the controlling factor in maintaining present numbers of deer in the project area becomes the ability of the surrounding land areas to accommodate the number of deer displaced from the land preempted by the proposed Waterway. The deer population of surrounding land is most likely in equilibrium. Individuals displaced by the Waterway will increase the pressure of the finite resource supply and possibly lead to the eventual loss of the displaced individuals.

The preemption of permanent pastureland by the proposed Waterway and hence, the impact upon the predominant grazers (cattle, horses, and sheep) in the project area do not appear to be particularly significant; only about 200 acres of permanent pasture will be lost due to construction of the canal. The number of livestock capable of existing on this amount of land should be fairly easily accommodated on the remaining pasture with no significant loss in numbers.

E-89 Migratory Species

Of the 372 different species of land birds, shore birds, and waterfowl noted as occurring in the area, only about 9 percent (24 species) are considered to be permanent residents.[22] This indicates that most of the species and the majority of the individuals are migratory. Therefore, any impacts upon the migratory birds could be significant from the standpoint of effecting changes in these species or their numbers which, in turn, could potentially affect areas far removed from the canal route.

Since there is an apparently normal fluctuation of both numbers and types of species migrating through the area over a period of years, the quantitative assessment of any impacts due to the proposed Waterway would be extremely difficult. Generally speaking, the most likely impacts upon the migratory waterfowl and shore birds probably will be temporary displacement resulting from construction activities such as noises, habitat disturbances, silting of water bodies, and dredging. There is also the potential for a slight reduction of areas for breeding, nesting, resting, and feeding. However, this is expected to have only minor implications, since the more significant birding areas such as the marshlands and small vegetated ponds utilized by nesting waterfowl are located, for the most part, away from the canal route. Somewhat similar impacts (temporary displacements during periods of peak construction activity) would also be expected to accrue to localized populations of land birds. Similar habitats in the area appear to be sufficient to accommodate the local populations that would be temporarily displaced by the construction activity.

The proposed project appears to offer ample opportunity for the development of effective waterfowl management areas that would help to reduce adverse impacts. The physical presence of the Waterway and associated surge basins will provide the area with additional shoreline and water habitats that could be used as resting areas for the migrant birds. In addition, selected adjacent land areas could be planted with types of vegetation preferred by the waterfowl and either permanently inundated or flooded at times, corresponding to the annual migration periods.

E-90 Small Game Animals

The significance of small game animals, of which rabbits and pheasants are the most predominant in the project area, stems from the fact that they occupy an intermediate position in the food web. Consequently, any significant changes in absolute or relative numbers resulting from the project would signal a shift in the stability of the natural ecosystem.

Both pheasants and rabbits are reported abundant in the area potentially affected by the Waterway, with high populations being sustained by ideal habitats.[23] Posting of many farms in the area also helps to maintain the wildlife populations at a high level. Detrimental impacts in the form of a reduction in the abundance of these small game animals would be a direct result of the loss of habitat and food resources utilized by this group. Approximately 2700 acres of land, presently utilized or available for utilization as wildlife habitat, would be preempted by the proposed canal. This figure includes land presently utilized for high-intensity agricultural operations, cropland and cropland pastures, permanent pastures, brush cover, and wooded wetlands favored as habitats by small game animals.

As these wildlife forms are somewhat tolerant to various forms of human intrusion and activity, no extremely detrimental impacts are expected to accrue to this group. Rather, some moderate impacts upon localized populations of this group will result from elimination of habitat and food resources. Habitat destruction along with associated construction activities will no doubt result in a forced relocation and population imbalances in other areas which could result in the loss of individuals and/or habitat damage due to overgrazing.

E-91 Rare and Endangered Species

Six species, which have the official status of rare or endangered, have been identified as having Niagara County within their ranges (see discussion in Paragraph E-34). No species endemic to the United States or endemic to New York State were identified.

At this time no ecologically viable populations of any of the rare or endangered species is known to inhabit the Niagara Peninsula or the specific route of the Waterway. Thus, any impact to rare and endangered species as a result of the project would stem from effects to an individual of the species passing through the area. Impacts of this type might include a further reduction of attractiveness of the natural setting to the endangered eagle and peregrine falcon should they be in the area. The general reduction of available natural habitat may further have some slight effect on any species bordering on rare and endangered status.

Because of the extremely limited number of sightings of the rare and endangered species in the area, the presence of resident populations is highly unlikely. Any potential impacts associated directly with the development of the Waterway would in all probability be indistinguishable from those perpetrated by increasing urbanization within the region.

E-92 Aquatic Ecosystems

Potential impacts arising from construction and operation of the LE-LO Waterway, and rendered to the components of the principal aquatic ecosystems discussed in the section on Assessment of Baseline Conditions, page E-4 (upper Niagara River and the inshore area of Lake Ontario near the proposed northward termination of the canal) were evaluated in conjunction with projected baseline conditions for each indicator. Extent or magnitude of impact is defined within the discussion pertaining to each indicator; exceptions occur for parameters where it was deemed that no impacts would arise.

E-93 Vegetation

Destruction of aquatic plant species on Squaw Island, upper Niagara River, due to construction activities will result in a negligible impact. Elimination of a relatively small amount of plant biomass is not detrimental in the context of overall community macrophyte biomass of the upper Niagara River ecosystem. No forseeable impacts will be rendered to phytoplankton communities and filamentous periphyton algae.

E-94 Zooplankton

Impacts to zooplankton communities resulting primarily of temporary toxicity and turbidity effects of dredged spoil will be insignificant, below detection, or less than the statistical fluctuations in the ecosystem.

E-95 Benthos

Dredging selected areas within the upper Niagara River which are not already maintained as navigation channels will eliminate benthic inhabitants in these areas. However, the channel will require only a small portion of the total river width and impacts to the benthos populations elsewhere are, at this time, judged as minor or obvious effects. The dilution of the dredged spoil to the large volumes of river water will rapidly diminish any smothering or abrasion effects these sediments might have on organisms outside the zone of dredging. The river ecosystem can probably accommodate these small shifts in total numbers of individuals inhabiting the river bottom without incurring great damage. Such shifts should have little effect on other species feeding on benthic organisms.

E-96 Fishes

Dredging of sediments located near the east bank of the upper Niagara River and Niagara River East, which are not already maintained as navigation channels, might result in the release of toxic materials accumulated over the years from industrial outfall. As a consequence of such dredging, fish kills could result. Fishes killed would include game as well as rough species. Such effects will probably not have long-term consequences since the released toxic materials will be eventually washed from the system. This assumes, of course, that pollution control regulations will prevent the continuing discharge of such compounds.

Consideration must be given to the quality of water discharged from the Waterway into Lake Ontario, with an evaluation of possible attendant effects upon in-shore communities in the lake. Especially pertinent quality characteristics will be water temperature and turbidity. It should be noted that projected baseline for water quality entering the canal from the Niagara River East is expected to be vastly improved, due to pollution-control regulations as well as the removal of toxic sediments by dredging operations, over present conditions.

A comparison of surface-water temperature between feed water for the Waterway and Lake Ontario, plus an estimate of possible water-temperature increments incurred within the Waterway, will aid in forecasting potential thermal inputs to Lake Ontario. Since water temperature differentials are most likely to be greatest during the warmest months, observed summer (July and August) temperatures of surface waters in the Niagara River and in Lake Ontario will be utilized. Water entering the Niagara River reaches a maximum temperature of 24 C during the summer.[31, 66] Summer surface-water temperature in Lake Ontario generally averages 23 C; however, temperatures between 23-28 C have been recorded for short periods in near-shore areas.[67]

Since surface temperatures of water bodies are associated with air temperatures, maximum temperature increases of Waterway water can be indirectly estimated from air temperatures for the area during July and August. Average daily maximum temperatures in the Buffalo vicinity for late July and August have been recorded as 28 C.[68] This temperature approximates maximum possible water temperatures within the canal. Realistically, actual temperatures will be lower. Overall, the estimated maximum temperature differential between discharged Waterway water and Lake Ontario surface waters is 5 C; average temperature differentials will be somewhat less than this value. Mixing in the discharge area will rapidly ameliorate temperature differentials. Moreover, a water temperature of 28 C is below the upper critical temperature limit for most fish species expected to be found in the discharge area.[67] Water discharged from the Waterway (35 feet in depth) should not interfere with summer thermocline stability in Lake Ontario. In the near-shore waters of the lake proximal to the position of the Waterway, the 10 C isotherm of the thermocline follows a summer mean depth distribution of 48 feet.[69] An increase of primary productivity in the discharge area due to increased water temperatures will probably be negated by increased turbidity of that water released from the Waterway.

At this time it appears impossible to forecast the extent of turbidity imparted to the Waterway feed water as a result of mixing action within the surge basins. Although it is predicted that water turbidity will increase within the Waterway, the magnitude of increase is unpredictable. It is anticipated that discharge of turbid water from the northward terminal lock into Lake Ontario might affect primary productivity and deteriorate potential fish habitats within the restricted area of the discharge.

E-97 Pest Species

Construction and operation of the Waterway will not enhance the perpetuation, invasion, or establishment of pest species in the associated aquatic ecosystems. Cladophora, an attached algal form, is not expected to develop into a major problem because of the limited substrate available for attachment (available only at the edges of the basins - the open water areas will be too deep for Cladophora) and of the stress of flucuating water levels in the basins. An invasion route for migration of potential colonists from Lake Ontario to Lake Erie already exists, i.e., the Welland Canal. Nutrient load of feed water for the Waterway is expected to be at a level such that Lake Ontario waters near the mouth of the proposed canal are not enriched; nuisance algal growth will not be promoted.

E-98 Rare and Endangered Species

The Waterway is not expected to play any part in the extirpation of rare and endangered species, nor will it precipitate the reduction of any species population to this status.

It is appropriate to consider in summary whether the Waterway (with surge basins), as an aquatic ecosystem, will enhance existing aquatic resources. In general, physical constraints intrinsic to the design and function of such a facility are not conducive to establishment of high-quality aquatic ecosystems. Overall, then, the construction and operation of the Waterway will not significantly perturb existing aquatic resources nor will its creation significantly improve the aquatic resource base.

HUMAN ENVIRONMENT

E-99 Introduction

Impact upon the human environment is defined in several basic ways. Particularly when considering the development of new facilities, such as major canal, port construction, or industrial developments, there is an important area of secondary impact that results from the immigration of nonindigenous peoples attracted by employment opportunities in both the construction and operation of the new facilities, as well as ancillary support activites. This, of course, is in addition to the primary impact upon the human environment associated directly with the development of the project. These include aesthetic, physical/chemical, and biological impacts that may affect the real or perceived health and well-being of individuals, or which may result in direct impacts upon nearby residents forced to relocate, or whose property use is restricted by development of the new facilities. Several analytically distinct categories of disruptions within the human environment can be identified, resulting from both primary and secondary impacts in the broad categories of socioeconomic and recreational and cultural factors.

(1) Impacts Upon Regional Economics and the Local Community Infrastructure. These include overburdening or otherwise disrupting utilities (water, sewer, power, and solid waste treatment capacities); transportation; medical services; cultural, social, and safety services; opportunities, including housing costs and availability, and employment/unemployment base, population growth income levels and distribution, and public service revenues.

(2) Impacts Upon Community Characteristics. These impacts include changes within the base social milieu of indigenous areas. Particularly major differences between indigenous populations are expected in such determinants as income, education levels, longevity (tenure), mobility, age, sex, marital status, number and age of offspring, voting patterns and political participation, and ethnic and racial characteristics.

(3) Impacts Upon Community Interaction and Integration. These impacts include those patterns that are established and define the basic activities of the community. Included are patterns of transportation, acquisition of goods and services, access and transportation to schools, hospitals, etc., patterns of communication and interaction among peer and cohort groups and extended families, recruitment and initiation

into groups and organizations.

(4) Impacts Upon Aesthetic, Recreational, and Cultural Characteristics. These consider those elements of the human environment that are defined by patterns of recreation and leisure activities, and resource utilization, including land use, unique historical or ecological areas that are important as educational or scientific sites, and aesthetics.

All of these areas are subject to impact of varying degrees resulting from the development of the proposed facilities. However, substantial variation in the extent and severity of impact may be expected depending upon local variables of site selection, construction, and plant operation technologies, public involvement and acceptance, and economic benefit to local residents.

The preceding constraints not withstanding, it is possible to identify potential problem areas resulting from development of the proposed facilities. The major area of impact is probably going to be in the localized impact of immigrant construction, and operating workers, ancillary personnel, and their dependents. Another important impact upon the human environment will result from major changes in the aesthetic, physical/chemical and biological environments, especially in land use and recreation patterns.

On the positive scale, there is likely to be a real economic stimulus to the area, with probable increases in employment, income, and associated community growth and expansion. Along with this, however, will be an inevitable change in the milieu of the area associated with increased population and activity.

Although it has been known that development affects the growth and nature of the social environment of an area, too often this aspect of large-scale development has been ignored. It has been ignored for several reasons: (1) lack of analytical tools to interpret the meaning of such impacts on a local area, (2) lack of persons (either within the administering agency or within the community) who are responsible for considering such impacts, and (3) lack of awareness on the part of the developers and members of the community that such development can result in such significant change in the social environment of the community.

While it is recognized that the proposed development can have important beneficial impacts - specifically, more jobs for more people - such development can often cause negative impacts on a community which are disruptive, particularly during the period of

transition. Such impacts include increased population (and changes in characteristics of the population and associated effects upon community integration); greater demand for housing, school, health care facilities, and other elements of the community infrastructure; disruption and increased demands made on the existing transportation system; nuisances from construction noise, odor, and congestion; major alterations in present and planned land-use patterns; and aesthetic impacts resulting from the development of such a massive project. A viable community is never static. Its positive or negative rate of growth is dependent upon its innate characteristics and the needs and demands made on it by its citizens at any particular time. However, introduction of a major water transportation route into a community greatly influences the direction, intensity, and nature of growth and change that will occur within a community. This section of the report addresses the nature of such changes that can be expected to accompany the introduction of the facilities included in this development project and their impact upon the various components of the human environment.

E-100 Socioeconomic Environment

E-101 Regional Economics

This section utilizes estimates of project employment, construction duration, and operation to derive probable socioeconomic impacts on the project area. These impacts are viewed in terms of the incremental changes in projected conditions as described in E-44, Regional Economics. In assessing probable regional economic impacts, it is necessary to assume several project characteristics on the basis of present knowledge of construction costs and other project features. The project is assumed to cost $2.24 billion for planning and construction with a total of 6 years required for actual construction of the project and 4 years for planning and engineering. Labor requirements for the waterway are shown in Table E-29 for both construction and operation.

TABLE E-29. LABOR REQUIREMENTS FOR CONSTRUCTION AND OPERATION[a]

Category	Percent
Construction	
Skilled	60
Semiskilled	15
Unskilled	25
Operation and Maintenance	
Skilled	40
Semiskilled	30
Unskilled	30

(a) Source: U. S. Army Corps of Engineers, Buffalo District.

The U. S. Army Corps of Engineers indicates that labor costs will be about 25 percent of contractor's earnings plus contingencies for construction and about 70 percent of operation and maintenance costs. Other facts important in assessing socioeconomic impact include the assumption that the canal will be too narrow for docking and no facilities for off-loading are planned at any point along the canal. The canal and abutting properties will require 10,000 acres of land in Niagara County. In some cases, payments in lieu of taxes will be made to school districts and municipal governments. These payments, however, will probably never be as high as the present yield of the lands which are taken off the tax roles. It is further assumed that all east-west roads will be left intact during construction until the bridges and tunnels are completed. Those which run north-south are expected to be removed as construction progresses. It is also assumed that construction of the locks and bridges will take place first, followed by the excavation and construction of the waterway itself.

Impacts are analyzed in terms of each of the significant indicators presented in Paragraph E-44, Regional Economics. Boundaries of the region of analysis as well as relevant data for projecting the baseline are presented in Paragraph E-44. Indicators for which impacts are thought to be significant include: (1) employment base, in terms of industrial and economic composition of the two counties; (2) population growth; (3) income levels and distribution; (4) unemployment rate; and (5) public services and resources, including transportation facilities

as well as community tax base. Impacts under each of these headings are discussed below.

E-102 Employment Base

Construction of the project is expected to create about 5,000 jobs annually during the 6-year construction phase of the project. Total numbers employed are expected to peak rapidly after initiation of the project and to taper off as the locks and cement work are completed. Since the generation of employment is the major factor in determining the other socioeconomic impacts, it is important to examine various assumptions regarding the area from which workers come. For example, if all employees come from within the two-county region, the nature of socioeconomic impacts will be significantly different than if all workers come from outside of the region. In defining the potential nature of impacts, three cases are postulated. Impacts in employment are first analyzed on the assumption that all employees for construction and operation will come from outside of the two-county region; impacts are then analyzed on the assumption that 50 percent of employees will come from outside of the two-county region; finally, impact on employment is analyzed assuming that all employees will come from within the commuting radius or two-county region for the project.

The basis for analyzing employment impacts is the projected level of employment in the construction industry for the 1985 period. Projections for the two-county area indicate approximately 31,900 workers in the contract construction sector of the regional economy.[48] The Erie-Niagara County Regional Planning Board population estimates upon which the construction employment estimates are based are higher than the projections used in the baseline description of this report. The relatively small difference in estimates, however, is not considered significant for purposes of this analysis; the important factor is the percentages involved. If, at the outset of construction all workers come from outside of the region, this would indicate an increase in the projected contract construction labor force of 16 percent. Conversely, if all laborers come from within the region, the project would employ about 16 percent of the projected construction labor supply for the area in 1985. If more conservative projections of labor supply are used, these percentages would be proportionately reduced although in all cases the magnitude of differences is relatively small.

As can be seen from the above statistics, even if all workers come from outside the region, the project will not constitute a major increment to employment during the construction phase. After construction when only 500 permanent employees would be involved, the primary impact of the Waterway would be relatively negligible in terms of the regional labor supply except for, presumably, a temporary, large number of unemployed construction workers at the end of the project. Primary and secondary employment impacts of the Waterway construction are discussed below in terms of income generation.

E-103 Population Growth

The long-term employment from the canal is approximately 500 workers. Assuming three dependents per worker or a family size of four, this would be an increase of 2,000 to a regional population of approximately 1.5 million. Even with secondary employment generated from these people, it is not anticipated that the Waterway will have any significant effect on long-term population growth in the two-county region. During construction, population in the area will swell by an amount corresponding to the proportion of workers and their families who actually enter the region from outside to participate in construction.

In addition, certain population increases might be anticipated with the expansion of retail and commercial activities associated with expenditures of the workers employed in the construction. Assuming a multiplier in employment of approximately 2.0 (an overestimate, which will probably not be exceeded, given the nature of increased demands for retail services), would indicate that during construction an overall maximum increase in the regional population of approximately 40,000 could occur, assuming an average family of four [(5,000 construction workers x 4) + (5,000 associated workers x 4)]. While this is insignificant on a regional level, such increases have important impacts when concentrated and allocated to specific localities in the neighborhood of the Waterway. No attempt is made here to deal with this locational or distributional question since it is not possible to predict where location will occur and to what extent labor will commute from within the region to the project without moving their places of residence.

E-104 Income Levels and Distribution

Expenditure of 2.24 billion dollars over a 6 year period will have certain predictable effects on regional income levels. Income generation will also have a distributional effect in terms of who receives income and the amounts received over the construction period. Assuming that the construction expenditures are divided evenly over the 6 year period, indicates an expenditure of 373 million dollars annually on the project during construction. (This is an overestimate of expenditures for construction since considerable expenditure will be necessary in planning and engineering of the project which occurs before construction starts in 1985.)

Additions to the regional economy will depend on the proportion of value added (wages, rents, interests, profit and taxes)* that remains in the regional economy as a result of project expenditures. Since elaborate analysis is precluded, several assumptions are necessary concerning the magnitude of this variable on an annual basis for the project. If all the factors of production that are to be employed during construction came from within the project region, the full increment of expenditure (373 million dollars annually) times the regional multiplier would provide an indication of the increase in expenditures and, consequently, incomes in the project area. Since the region is not self-sufficient, not all expenditures for factors of production will fall within the project area (examples include inputs such as cement, steel, excavation equipment, and other construction materials such as wood, fuel, and explosives). The value added that actually accrues to the region will be much less than the total annual expenditures for construction. One assumption which simplifies the analysis is that the only value added, accruing to the region, is wages and salaries for laborers and workers employed during the construction phase. This would represent a slight underestimation of value added from the original round of expenditures. To single out the whole value added would require knowledge of which firms are employed during construction and where ownerships of the firms and other factors of production reside. Since labor costs are 25 percent of contractors' earnings, approximately $93,250,000 would be expended on direct labor annually during construction.**

* Value added is the accepted measure of income generated from economic activity and is the basis for making projection of total income generation in a regional economy due to the expansionary effects caused by an initial project expenditure.

** This is slightly more than labor costs calculated on the basis of average annual wages for contract construction ($12,000 annually - Monthly Labor Review, February 1973) times 5,000 workers or $60,000,000.

Income earned by labor will in turn have a multiplier effect based on the portion of net income laborers expend on goods and services and the proportion of these expenditures which, in turn, are spent on other goods and services within the region. The multiplier effect results in an increase in regional expenditures as recipients of the initial spending, in turn, make expenditures for goods and services. It is not possible within the scope of this study to make approximations of the regional multiplier, although other studies indicate values for the multiplier ranging anywhere from 1.5 to 3[70]. For purpose of analysis, a multiplier for construction employment has been estimated at approximately 1.7. Based on a multiplier of 1.7 and the assumption that the regional value added associated with the project is related to wages, annual increase in regional incomes as the result of the project will be approximately $159 million. The use of a low estimate for the multiplier from construction expenditures reflects the fact that wage expenditures generally do not generate significant amounts of secondary income. Workers spend their money primarily on such items as food, rent, gasoline, and other consumption expenditures. The amount of value added that remains in the region from these expenditures is primarily in terms of wages paid rather than actual products produced, indicating that the overall impact on the local economy is likely to be less than for other forms of expenditures such as industrial expansion. In terms of the proportion of annual income represented by this increment to the regional economy, rough estimates of personal income for 1970 for the two-county region indicate the income in 1970 was $5,410,800,000. Based on projections for per capita income for 1985 of $4,765 and the population projections for 1985, of 1,450,000, a projected income for the region of $6.9 billion seems reasonable for 1985.[44,48] A $159 million increase in annual income during the construction period would represent approximately a 2.3 percent increase in annual regional income resulting from construction of the project.

In terms of income generated after construction, approximately 500 people will be employed on an annual basis. Since information on which to determine specific job categories and pay scales was not available for the study, it will assumed that the average annual wage after 1985 will be $15,000 ($3,000 higher than the present average wage in construction). No attempt is made to refine or otherwise determine the validity of this estimate, since only coarse approximations are being attempted here. This would be an annual expenditure for wages and salaries of $7.5 million. If the multiplier of 1.7 is used, this would indicate an annual addition in income to the regional economy of $12.8 million (approximately a 0.2 percent increase over projected income).

Other things equal, construction of the waterway could be expected to stimulate new industrial locations that would add employment to the regional economy. However, several factors mitigate against this. First, the waterway in all likelihood will be too narrow for construction of adequate docking facilities other than at the entrance at North Tonawanda and there are no plans for facilities there. Second, other port facilities in this region such as Buffalo and Toronto service the region's transportation and trans-shipping requirements. Third, the commodities and substance that will be shipped through the waterway, primarily bulk commodities, require processing facilities that are generally neither located near nor likely to be built because of the waterway. Fourth, other locational factors will play an important role in future industrial expansion and location in this area, e.g., wage rates and other economic conditions determining locational choices. The trend has been for firms originally located in this area to expand into other parts of the country where wage rates are more favorable and markets are closer. On the basis of above considerations, it is assumed that the waterway will not have extensive potential for inducing new industrial location. Without resultant new industrial location, there will be no significant additions to employment other than that occurring during construction and operation of the canal itself.

In terms of the impact of construction and operation of the waterway on income distribution, little can be said without knowing specifically whom the project will employ. On the basis of the percentage breakdowns of skill categories, 1,250 unskilled workers and 750 semiskilled workers will be employed during construction. To the extent that these workers come from the pool of unemployed labor in the project region, the project will have some effect on the distribution of income. On the other hand, if the semiskilled and unskilled workers who are employed on the project are brought in with the contractor or are workers who have left recently phased-out projects in other parts of the country, little impact on the distribution of income will result. This subject is discussed further in the Section on unemployment rates.

E-105 Unemployment Rate

Historically, the Niagara and Erie County area has had a higher unemployment rate than the State of New York as a whole (see Table E-7). If the assumption is made that the higher than state average unemployment rate will hold in the Erie and Niagara County area until 1985, the project has the potential for having a significant temporary effect on the employment rate. As indicated earlier, the magnitude of this effect will depend primarily on the source of labor supply for the project. It will also depend on the magnitude of unemployment in

specific sectors of the regional economy, primarily in contract construction. Unemployment in the construction industry at the time of the start of the project will be a direct function of national economic conditions, particularly the overall level of interest rates and the general building market. If it is assumed that employment will be relatively high in the construction trades in 1985, then the project has the potential for significant short-term beneficial effects on construction employment. However, the long-term effect of the canal on unemployment rates in the area is likely to be minimal. This assertion is based on the fact that only about 500 people will be employed permanently, and the likely influx of workers for construction will result in a temporary increase in unemployment at the end of construction until workers can find other job opportunities in the area or move to projects in other parts of the country.

E-106 Public Services and Public Service Revenues

The project will have several impacts on the public service sector of the regional economy, particularly in the Niagara County area. First and foremost of these is the removal of an estimated 10,000 acres of land from the local tax base. No specific estimates and breakdowns by category of property value was possible during the course of this study. Data were found, however, indicating that the value of agricultural lands and buildings was approximately $3,800 per acre in 1970. Since some of the land that will be taken for the canal is woodland and pasture and some is residential, the average value of $3,800 per acre appears to be a fair approximation for the wide range of property values along the waterway route. Given the urbanizing trend in some of these areas, it can be assumed that property values in the path of the waterway will rise more rapidly than those of already urbanized areas between the present and the start of the project. Thus, a differential growth rate between the total assessed valuation for the county and the assessed valuation for the area impacted by the project is used.

In the baseline description section, it was stated that the market value of property in Niagara County has grown at a rate of about 2 percent between 1967 and 1970. This 2 percent growth in property values has been extrapolated to 1985. It is further assumed that agricultural properties will increase at a slightly higher rate of approximately 4 percent. At the present average per acre property values of $3,800 per acre and a growth rate of 4 percent between 1970 and 1985, property values are projected to be approximately $6,800 per acre in the areas to be used for waterway construction and operation. At the

same time, the 1970 market value of land in Niagara County of $1,239,000,000, projected at a 2 percent rate, would be $1,668,000,000 by 1985. Thus, construction would remove approximately 4.1 percent of the county's projected 1985 tax base as estimated by the growth rates of the affected lands as well as growth in the total market value of land in Niagara County between 1970 and 1985.

In addition to direct loss of property tax base, the Waterway can be expected to have certain impacts on property values adjacent to its route. Where the Waterway divides farms or significantly reduces the acreage that is presently under cultivation, the remaining acreages could be expected to decrease in value over time due to the reduction in total acreage of the farm. Assuming that other farmers would be willing to acquire the affected operations, property values would probably not be affected significantly. In terms of residential properties, it is not clear what impact the location of the Waterway will have. Intuitively, however, it would appear that many property values would decline as a result of noise from operations and the general adverse aesthetic effects associated with the above-surface-level portions of the Waterway. No predictions or estimations are possible, but these impacts are important in considering the over all effects of property values.

Perhaps the most significant effect that the Waterway construction will have is the potential influx of workers and their relationship to the financial support of various public services. These include community facilities such as schools, roads, health facilities, sanitation and other infrastructure services provided by local communities. It is possible that some increase in tax revenue associated with arrival of new workers might occur either through increased property values or through payments of income tax. If these increased revenues correspond to the increased costs of providing services associated with the new demands, then, from a community financial point of view, no major impact from these demands would be anticipated. On the other hand, if the arrival of new workers means a less-than-proportionate increase in local revenues, such as occured at the Robert Moses Power Plant, local communities could be expected to experience an adverse impact in terms of additional demands on their public services. Alternatively, construction may not involve movement of significant numbers of workers to new locations within the region. If this is the case, then no significant effects will result from the minor increase in demands for public services.

None of the Niagara County communities that would be potentially affected by construction of the Waterway (such as Ransomville, North

Tonawanda, Pekin, Bergholtz, or Sanborn) have income taxes on residents of the city or individuals working within the village or city boundaries. County taxes vary from township to township and from village to village. For example, in Lewiston Township the rate is $15.87 per $1,000 of valuation, in Porter Township (Ransomville) the rate is $12.45 per $1,000 assessed valuation, and in North Tonawanda the rate is $28.88 per $1,000 of assessed valuation. Each community has property taxes for support of community general funds and/or for provision of water, sewer, and other public services. No attempt was made, however, to determine the tax rates and equalization rates (percent of full market value represented by assessed value) for each of the individual communities. The important criterion in evaluating the potential for impact is the relationship between the increase in demand for public services within a community and the generation of increased revenue. If property values do not increase in proportion to these increased demands, there will be an additional burden on local services. This will be particularly true in terms of school districts for which approximately 60 percent of annual revenues come from property taxes.

The influx of new workers, who will reside in either existing housing or trailer parks, raises certain problems in terms of revenue generation from the property tax. Property taxes on trailer parks are assessed upon the extent and value of the owner's land and development. The owner can in turn bill each plot individually. Assessments are based on the number of pads, facilities for public service, and other improvements such as community houses or recreational facilities. Bluebook prices on the cash value for each trailer are determined at the time of assessment and are part of the improvement value tax for the trailer park. Water and sewer services provided to the trailer park are also taxed on the basis of the meter rate for water and 25 percent of water meter flow for sewer charges. It is not possible within the scope of this study to determine whether the revenues generated from trailer parks, or new units added to trailer parks, cover the demands put on public services such as schools or other facilties. It is likely, however, that increased revenue would not correspond to increased expenditures. The same applies to situations in which more than one family occupies a single dwelling intended originally as a one-family unit.

In terms of disruption of transportation facilities caused by the Waterway, the associated economic impacts are assumed to be minimal both during and after construction. This assumption is based on the propositions that all roads will be maintained until the regional highway system is consolidated, and bridges or underpasses are built at

appropriate crossing points along the canal. It is also assumed that rerouting the roads and rail lines will not result in increases in transportation costs to communities presently dependent on these facilities.

E-107 Social

Impacts upon the human environment are determined primarily by assessing changes in the existing social base and incumbent social norms and values of affected communities. Included in the analysis of impacts upon the social base are potential changes induced by this project in the characteristics of the population. Also included are the expected impacts upon established patterns of community activities and community integration.

From an analytical perspective, several temporal and spatial communities will experience impact: the indigenous population, the immigrant population, the combined indigenous and immigrant community, and the residual population remaining in the area after the project has been completed.

For the purpose of this analysis, impacts are considered primarily from the perspective of the base indigenous community. Substantial deviations from the existing indigenous population characteristics, activities and integration resulting from development of the proposed project are considered impacts.

E-108 Community Characteristics and Patterns

Community Characteristics. It is anticipated that the construction activities associated with the development of the Waterway will result in changes or impacts to characteristics of the community population. The form and degree of resulting impacts will vary depending upon the proportion of construction workers who come from outside the project area. The greater the percentage of construction workers moving into any specific community, the greater the degree of impact. The degree of impact will also depend upon whether the immigrating construction worker is accompanied by his family into the community. The most important impact will occur through an increase in population and consequent infrastructural demands for housing, additional school facilities required by children of construction workers, health care facilities, and changes in age, sex, ethnic, and racial composition of the base population.

It is assumed that these impacts will occur over the two-county region. It is anticipated that there may be a disproportionate concentration of this population in Niagara County, particularly in the Niagara Falls and Lockport area, as well as in part of northern Erie county and, of course, in the 10 census tracts that include the Waterway route. The distinct possiblity that much of the temporary population increase may concentrate in such localized areas may result in very significant localized impacts upon the social environment of those affected base communities.

Community Activity and Integration Patterns. Impacts from the waterway on patterns of community activities will include disruption caused by changes in the existing transporation network, disruption caused to individuals who must relocate their homes or businesses, and changes in such activity patterns caused by the influx of construction workers and support personnel to the area.

The present construction plans call for the permanent closing of 10 of the 18 roads over the Waterway route. Although passage over the route will be provided for the other 8 roads (either by bridge or tunnel), the closing of the 10 roads will inconvenience those accustomed to using them. The severity of this impact is extremely difficult to anticipate because the magnitude depends upon the number of people affected and the extent of additional distance and time required to travel by the new transportation network. The greatest degree of inconvenience can be expected to result from the closing of Ransomville, Lower Mountain, and Niagara Roads. This inconvenience may affect fire and police services, clubs, church, school, and other social activity participation, as well as possibly changing school district boundaries, and affecting shopping and service acquisition patterns.

Forced relocation of some 300 homes, farms, and businesses can be expected to have obvious and significant impacts on many of the people who must relocate. Again, the magnitude of this impact and even the net direction (positive or negative) of impact are very difficult to predict because it will depend upon the nature of many individualized situations. However, it can be expected that strong objections to relocating will be expressed, at least by some individuals. Relocation of families can also be expected to impact existing patterns of social interactions since some residents can be expected to move far enough away from their present location to largely destroy existing social interaction patterns, and force them to establish new patterns of activities and communication with different people.

Some impacts and changes in patterns of social interaction can be expected to result from the introduction of construction workers and their families into the area. The extent and nature of these impacts will depend upon the number and concentration of construction families moving into the area. It cannot be stated whether the net impact will be positive or negative.

An Example. It is likely that many construction workers would locate in or near Bergholtz, an area convenient to the waterway and suitable for trailer park development. Assuming that 500 of the construction families locate in the Bergholtz area and assuming an employment multiplier of 1.7 and a family size of three, there will be a total of 1350 family heads supporting an additional community of approximately 4050. Daily activities of this additional population by its mere physical presence is going to interfere with the patterns of the base Bergholtz community which is less than 2,500.

In addition to their different tenure characteristics, this immigrant population is probably going to have a different family life cycle distribution than the base population. It is likely to have disproportionately large numbers of young single maies and young marrieds with preschool and elementary school children, creating excessive demands on existing nursery and elementary school facilities.

The projected median economic profile of the immigrant construction family is approximately $12,000.* This is a marked contrast to the base Bergholtz median income of approximately $10,500. The implication of this difference is that there will not only be changes in community economic activity patterns, resulting from greater economic demands of more people, but the expected increase in community discretionary income is likely to result in localized inflation.

If 20 percent or 810 individuals of this immigrant population registered to vote, they could not only affect local village politics, but would affect the entire voting district, adding approximately 5 percent to the 138th State Representative District.

It is also likely that the racial and ethnic composition of the immigrant population will differ significantly from the indigenous base. Assuming the national average, black population composition of roughly

* Based on 1972 Contract Construction average weekly earnings of Census tract 232.73.

10 percent, there would be an additional 405 blacks added to the 8 or less than 1 percent presently in the area. There would likely be a significant difference in the area ethnic composition in that the immigrant population will not be likely to share the ethnic characteristic distribution of the predominantly German-extraction base community.

This is a hypothetical example of social interaction impacts. The magnitude of impacts actually incurred by the influx of construction workers cannot be assessed until the number and social and familial characteristics of the workers are known. However, this example provides a description of the kinds of social impacts that should be expected due to the influx of a large number of construction workers and their families.

Sensitive Areas. Little direct impact is expected on the residents of the Tuscarora Indian Reservation. This statement is based upon the assumptions that no land from the reservation will be needed for the construction or operation of the waterway and that the physical, biological, or aesthetic integrity of the reservation will not be imposed upon. There is reason to suspect, however, that the construction of the Waterway may adversely affect the stability of the reservation game population altering the rate of harvest by the Indian community, and have other important indirect impacts upon the area.

Given the unique character and cultural base of the reservation population, a special study investigating potential impacts and ameliorations should be undertaken.

E-109 Aesthetic, Recreational, and Cultural Environment

E-110 Educational/Scientific Packages

E-111 Unique Natural Features

The ecological, educational and scientific value of Bond Lake will be greatly impacted and perhaps obliterated if Bond Lake is changed significantly from its existing condition as presently planned.

The only existing large natural habitat in the area supporting many native plants and animals is located on the Tuscarora Indian Reservation. Present route plans will not directly impact the reservation area. An assessment of negligible habitat impact, however,

would be based on the assumption that no land from the reservation will be needed for, or its use characteristics changed by, the construction or operation of the Waterway.

The educational and scientific value of the Escarpment (which the Waterway route will traverse) may potentially be enhanced by the Waterway development. Cuts in the Escarpment, exposing material content, will provide an interpretive geological resource.

E-112 Unique Cultural Features

No archeological sites along the immediate proposed Waterway route have been identified. However, to avoid possible impacts on unknown sites, it is suggested that, preliminary to and during the construction phase of the Waterway, attempts be made to identify such sites. Should sites be located and properly excavated by trained personnel, a net benefit would result.

There is a growing movement within the community of Bergholtz to preserve a number of buildings and structures in the area of historical significance and value. If this area is eventually developed into a historical village, the Waterway can be expected to have a negative impact upon its atmosphere. In addition, damage to existing structures can be expected from blasting and heavy earth-moving activities associated with construction of the project.

The Bergholtz Cemetery will not be directly affected by the Waterway. This statement is based on the assumption that no activities related to construction or operation of the Waterway will take place within the boundaries of the cemetery. However, because of the immediate proximity to the canal, violation of the visual and aesthetic integrity of the cemetery is anticipated.

The two National Historical Register sites – Fort Niagara and Niagara Falls – are not expected to be affected in any significant way by the Waterway. One possible effect, though probably relatively minor, might be a change in the number of visitors to the two areas, attracted to the general area by the recreational aspects of the Waterway.

E-113 Recreation

The impacts discussed below are anticipated as a result of the construction and operation of the Waterway during the period 1990 to 2030. Impacts of recreational facilities built in conjunction with the canal are specifically excluded. Impacts such as those resulting from necessary highway relocations are included. All identified impacts are summarized in Table E-30.

E-114 Recreational Supply

Five types of impacts on recreation supply are identifiable: (1) direct loss of recreation facilities, (2) reduced carrying capacity on present boating sites(3)reduced carrying capacity for fishing, (4) capacity changes due to altered aesthetics, and (5) reduced access to recreation facilities.

Direct Loss of Recreation Facilities. These impacts result when the Waterway itself, its construction, or highway relocations preempt recreation lands. Five such preemptions are identifiable.

A 150-acre open space area on Squaw Island proposed for 1971-1980 development as a high school athletic area would be largely destroyed by construction on a canal and lock on the island. The proposed recreation facility would serve the immediate Buffalo area only.

A portion of the existing Riverview Park in North Tonawanda would be taken for the Waterway entrance from the Niagara River. Construction activities would displace nearly all park use until Waterway completion. The site currently contains 53 acres with a 47 acre addition proposed. Relocation of River Road and abandonment of the adjacent railroad would present new opportunities for expanding the park area. On the other hand, the high bridge required for River Road over the Waterway would have a visual and possibly a noise impact upon the park. The significance of the impacts cannot be readily estimated at the present time. The net effect may be beneficial, however, since highway and rail traffic detract considerably from a park-like atmosphere.

Oppenheim Park in Wheatfield would lose much of its current 69 acres and a proposed 177 acre addition through Waterway construction and the relocation of Route 62. Impacted uses, existing and proposed, include picnicking, field sports, a zoo, a swimming pool, hiking-bicycling

TABLE E-[illegible]. SUMMARY OF PROJECT IMPACTS ON RECREATION

	Approximate Magnitude	Scope	Timing	Cause	Significance
Impacts on Recreation Supply					
Direct Loss of Facilities					
[illegible]	[illegible] acres	Local	Construction and operation	Canal construction	Loss of entire school athletic area
[illegible]	[illegible] acres	Local	Construction and operation	Canal construction	Loss of [illegible] of park
[illegible]	[illegible] acres	Regional	Construction and operation	Road relocation and canal construction	Loss [illegible] park and small [illegible]
[illegible]	2[illegible] acres	Regional	Construction and operation	Road relocation and surge basin	Major damage to large facility
[illegible]	Small	Regional	Construction and operation	Road relocation	Minor damage to medium size facility
[illegible] Capacity [illegible] Boating					
[illegible]	Small	Local	Operation	Canal traffic	Minor
[illegible]	Small	Local	Construction and operation	Traffic	Minor
[illegible]	Small	Local	Construction and operation	Traffic	Minor
[illegible]	Small	Regional	Construction and operation	Traffic	Minor
[illegible] Capacity [illegible] Fishing					
[illegible] State Park	Small	Regional	Construction	Pollution, dredging	Minor
[illegible]	Moderate	Local	Construction and operation	Traffic, dredging	Minor
[illegible]	Small	Regional	Construction and operation	Traffic, dredging	Minor
[illegible]	Small	Regional	Construction	Pollution, dredging	Minor
[illegible] Aesthetics					
[illegible]	Large	Regional	Construction and operation	Canal [illegible] relocation	[illegible]
[illegible]	Small	Regional	Construction and operation	Canal [illegible] relocation	[illegible]
[illegible]	Small	Local	Construction and operation	[illegible]	[illegible]
[illegible]	Small	Regional	Construction and operation	[illegible]	[illegible]
[illegible]	Moderate	Regional	Construction and operation	[illegible]	[illegible]
[illegible]	Large	Regional	Construction and operation	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

trails. The highway relocation, which includes a high bridge, might take a relatively small portion of the proposed addition, but would considerably detract from the park value of the remaining portions. The net loss of facilities and capacity at Oppenheim Park would be primarily of regional significance.

Much of Bond Lake Park (currently 501 acres, with a proposed 130 acre addition) would be inundated by a surge basin on the Niagara Escarpment. Over $4 million of developments are currently planned for the area, including nature centers, boating areas, hiking-biking trails, day camp areas, a swimming pool, and a golf course. Loss of any substantial portion of this park would be a significant regional impact.

A proposed 200-acre town park on the Lake Ontario shore at Sixmile Creek would be affected by relocation of Youngstown Road and State Route 18 and construction of their tunnel under the canal. This is a regionally significant area proposed to serve mainly fishermen and picnickers.

Reduced Carrying-Capacity **on Present Boating Sites.** **Presence of large** ocean-going vessels on the upper **Niagara River and in the Waterway** may slightly restrict the activities of pleasure boaters when the Waterway is in operation. Sites directly affected include: La Salle Park, Buffalo; Niawanda's Park, Tonawanda; Isle View Park, Tonawanda, and a proposed State Park on Strawberry and Motor Islands. Boating in the channel east of Beaver Island State Park may also be curtailed. Such impacts, however, are expected to be of only minor significance. **Further, the proposed canal and surge basins would provide a substantial increase in water surface area, expanding the over-all carrying capacity for boating .**

Loss of Carrying-Capacity for Fishing. Possible fish kills and temporary population reductions due to dredging of the river channel may decrease the sport-fishing potential of several sites during construction. Potentially impacted areas include: Beaver Island State Park; Riverview Park, North Tonawanda; the Sixmile Creek area on the Lake Ontario shore; and the upper Niagara River in general. If projected water-quality standards are met and discharges from ships are carefully controlled, impacts due to water-pollution during Waterway operation should be small. The increase in water temperature in the immediate area of the Waterway outflow into Lake Ontario may locally increase the fishing potential of the area.

Capacity Changes Due to Altered Aesthetics. Portions of the Waterway will be significantly below or above ground surface. In an

area of primarily flat terrain (excepting the immediate Escarpment area), the visual impact on some recreation areas may be substantial. The aesthetic appeal of the Oppenheim Park area, for example, will be reduced by the intrusion of the Waterway and its ship traffic in a park setting. Similar visual intrusions may affect proposed facilities at the Sixmile Creek Park, on Strawberry Island, along the Lake Ontario Parkway, and along the Niagara Escarpment Trail. At the Escarpment, the impact on the trail and on Bond Lake may be particularly dramatic since the Waterway will be diked and above grade. Most impacts of this type will detract from the recreational value of park areas. There may be exceptions, however, when the canal and its associated traffic add interest to a scene and may make areas more popular for picnicking. Impacts of this latter type are assumed to generally imply transfer of use from alternative sites in the region, as described in the section on Displaced Recreation Demand.

Reduced Access to Facilities. The Waterway will serve as a north-south barrier, limiting access to some sites. Continuous open space corridors such as the Niagara Escarpment Trail and proposed corridors east and west from Oppenheim Park will be particularly affected. If adequate crossings are not provided to permit horse, foot, and bicycle traffic, these corridors will be substantially reduced in value. The construction phase may be particularly disruptive to corridor use.

E-115 Recreation Demand

Newly Created Demand. The proposed canal may directly increase the demand for recreational opportunities by attracting new tourists to the area, encouraging longer stays, and increasing the resident population through work force required for construction and operation. The first two effects cannot be quantified in advance of the project, but are expected to be small.

The recreation demand impacts of new residents are expected to be moderate, when concentrated in a single locale. A peak construction work force of 5,000 people and an operating force of 500 is expected for the canal. It is possible that part of the work force can be recruited locally (Erie and Niagara Counties). The maximum size of the recreation impact can be anticipated by assuming that all come from outside the region. Allowing for the workers and their families, new service occupation workers and their families, the maximum

anticipated Niagara County population increase may be roughly 15 to 20 percent, with a corresponding increase in recreation demand. This demand will be of greater significance if these temporary population increases concentrate within the county. These calculations represent maximum possible impact. To the extent that local people fill the construction and service jobs, the actual impact will be reduced from this maximum. These population changes may result in heavy temporary stress on local park facilities.

Displaced Recreation Demand. The changes in recreation facility supply discussed above will result in the displacement of recreation use, creating increased demand on remaining facilities. The activities most likely to exhibit such displaced demand include water-based activities such as fishing and boating, and recreation corridor uses such as hiking, bicycling, and horseback riding.

An opposite type of demand shift may occur for picnicking. Waterway traffic may add interest to adjacent facilities and attract users who would otherwise picnic at other locations within the region. Areas that may experience increased use of this type include: Strawberry and Motor Islands State Park; Veteran's, Niowanda's and Isle View Parks in Tonawanda; La Salle and Front Parks in Buffalo; Riverview Park in North Tonawanda; and Oppenheim Park in Wheatfield. This type of new use may be especially noticeable at recreation areas near the ends of the Waterway or near locks; specifically, Riverview Park, Sixmile Creek Park, and Bond Park.

A similar shift in boating demand along the Lake Ontario shore may occur as a result of construction of the breakwater. This structure should provide a large new man-made harbor adjacent to Sixmile Creek Park. Boating along the Lake Ontario shore may therefore concentrate in the Sixmile Creek-LE-LO Waterway area.

The above impacts on recreation demand assume no recreational development of the proposed Waterway. To the extent that related facilities are developed, other demand shifts may occur from a variety of sites in the region.

E-116 Secondary Effects of Recreation Activities

Secondary impacts of the project on recreation are expected to be confined to in-region shifts from facilities associated with the Welland Canal in Canada. In 1970, tourists to the entire Canadian

Niagara Penninsula totaled 13, 709, 000 and spent $158, 000, 000. Visitors to the Welland Canal proper were estimated at 0.5 to 1.5 million. If one assumes these rates are stable, a proportion of this use would be shifted to facilities in the Waterway area. It is estimated that as much as 40-60 percent of the Welland Canal visitors (0.2 to 0.9 million) might shift. Because other facilities attract visitors to the Canadian Peninsula, smaller percentages of the total peninsula visitors and expenditures would be expected to shift. An undetermined amount of shift in recreation related employment would probably accompany in-region shifts of this type.

E-117 Aesthetics

The proposed Waterway would have a profound effect on the relief and topographic character of the land in the project area. The vertical distance between the overall land surface and the Waterway water level would range from approximately 80 feet below ground level to 80 feet above. At either level, the change in character is marked. This aesthetic impact is accentuated because the area shows very little other variation and that which does exist – the Escarpment – runs directly perpendicular to the proposed Waterway.

The odor and visual quality of the air would be significantly degraded during construction by the operation of heavy equipment and by blasting and excavating operations. Sound levels would be similarly increased. Both of these impacts would probably become minor once the Waterway is completed, though ship traffic and increased automobile traffic in the area may result in aesthetics being at a less desirable level than it would be without the project.

Water-related aesthetic impacts are most prominent in relation to the entirely new land-water interface zone created along the total length of the Waterway. Throughout the route, this interface will be distinct and artificially maintained. In the surge basins small (approximately 2 feet), but regular fluctuations in water level will detract from the attractiveness of the interface. If the Waterway edges, particularly in the diked areas, are adequately softened with landscaping, the undesirable interface characteristics will be significantly reduced. Appearance of the water in the Niagara River and Lake Ontario at the sites of the dredging operations will be very turbid. Turbidity should be significantly reduced in actual Waterway operation (assuming adequate control of erosion on the canal slopes), except in the surge basins where frequent water exchange will maintain a high level of turbidity.

The major breakwater to be constructed at the Lake Ontario entrance to the Waterway will also produce significant alteration of the land-water interface. This structure, 15 feet above mean water level and enclosing 1,650 acres of water, will produce a man-made harbor in marked contrast to the adjoining natural shore line.

The Waterway may have a positive effect upon the aesthetic aspects of biota in that waterfowl may be attracted to the surge basins. No significant impacts on the abundance of domestic animals or the visual diversity of vegetative patterns are expected – excepting, of course, the agricultural land actually taken by the Waterway and its associated facilities.

The Waterway will have a dramatic impact upon the aesthetics of man-made forms in the area, far overshadowing all other structures. This dominance will be particularly marked in the northern areas, to be crossed by high-diked portions of the canal, and at the highway bridge crossings to the south. Without exception, the structures will present a poor consonance with existing man-made and natural features.

The overall composition of the area will be impacted in two very different ways. The composite aesthetic effect of the Waterway in its land, air, water, biotic and man-made environment will be one of dissonance and contrast. At the same time the Waterway will present completely unique features adding diversity and interest to the landscape. Whether this added diversity will be perceived as desirable is problematical.

ENVIRONMENTAL AND RECREATIONAL PLAN

E-118 Introduction

The significant environmental impacts, both beneficial and detrimental, of the proposed Waterway project have been identified in the foregoing Assessment of Environmental Impacts. Through careful planning, adverse impacts can be mitigated and the full potential of the beneficial changes can be realized. It is the purpose of this section to develop a plan to accomplish these objectives.

The impacts have been organized according to the four major categories of the hierarchical assessment system used throughout this report (Table E-31). The plan presented treats each of these impacts. Some of the adverse impacts can be mitigated by changing the physical aspects of the Waterway. Examples of such changes include the alteration of the route and the relocation of a lock or bridge. Other detrimental impacts result simply because of the presence of the project and are unaffected by the specifics of alignment, lock location, or other physical attributes. Examples are the disruptions caused by the influx of a large, transient construction force and the loss of property taxes from land acquired for the Waterway. Mitigation of these impacts can be achieved by following certain administrative and management procedures. The plan developed here includes both physical alterations and changes in administrative and management procedures. Similarly, the recommendations for the development of the beneficial effects associated with the Waterway include physical changes, e.g., land acquisition for parks, and management procedures for operating such developments. Care has been taken to insure that changes to reduce or eliminate impacts in one area do not create significant impacts in other areas. Thus, the plan presented represents a net reduction in adverse impacts and a development of the potentially beneficial effects. Figure E-9 and Table E-32 map and summarize, respectively, the physical changes proposed in this plan.

The economic effects from the changes suggested in this plan have not been considered in any depth. A final accounting, comparing the environmental effects, the economic aspects, and the changes proposed by this plan, will be required to determine if this project is feasible.

TABLE E-31. A SUMMARY OF THE SIGNIFICANT LE-LO WATERWAY IMPACTS

Physical and Chemical:
- Noise during construction and operation
- Emissions to air (dust, combustion products) during construction and operation
- Excavation, transportation, and disposal of construction materials
- Alteration of groundwater system
- Relocation and disturbance of transportation systems
- Dredging and spoil disposal
- Water quality of canal discharge to Lake Ontario
- Altered surface drainage patterns
- Runoff from construction areas

Ecological:
- Loss of natural vegetation
- Loss of productive agricultural land
- Loss of wildlife habitat
- Temporary displacement of wildlife during construction
- Loss of aquatic biota due to dredging

Social:
- Disruption of transportation and interaction networks
- Burden on public services by temporary construction force
- Increased regional income and retail trade during construction
- Loss of property taxes
- Change in population makeup due to influx of construction workers
- Relocation and/or damage of residences and businesses

Recreational and Cultural:
- Loss of acreage in 3 existing recreational facilities
- Loss of proposed recreation facilities
- Recreational opportunities offered by the canal
- Visual impact of dikes
- Reduction in recreational use of Welland Canal
- Loss of educational/scientific sites
- Potential excavation of archeological sites
- Disruption of historical atmosphere of Bergholtz

TABLE E-32. SUMMARY OF THE CHANGES IN THE PHYSICAL STRUCTURES, ALIGNMENT, AND TRANSPORTATION NETWORKS AND OF THE RECREATIONAL DEVELOPMENTS PROPOSED TO MITIGATE IMPACTS AND DEVELOP BENEFITS ASSOCIATED WITH THE LE-LO WATERWAY

(Letters correspond to those on Figure E-9)

A.	Barrier in Niagara River to keep polluted water from Tonawanda and Ellicott Creeks out of canal
B.	Proposed expansion and alteration of Riverside Park
C.	Zone suitable for recreation development including relocation of Oppenheim Park
D.	Scenic highway paralleling the canal from Lake Erie to Lake Ontario
E.	Rerouted Penn Central-Erie Lackawanna Railroad line; potential recreation area
F.	Proposed north-south hiking-bicycling trail
G.	Rerouted canal
H.	Rerouted State Highway 429
I.	Proposed picnic facilities
J.	Realigned surge basin for Lock 4-5; reversed lock operation facilities
K.	Proposed Waterway Visitor Center
L.	Proposed winter sports area
M.	Relocation of Simmons Road
N.	Relocated surge basin for Lock 2-5
O.	Relocated Lock 2-5
P.	Rerouted Penn Central Railroad
Q.	Rerouted County Highway 93
R.	Realigned surge basin for Lock 1-5
S.	Temporary settling basins for construction runoff
T.	Proposed small-craft docking and breakwater fishing facilities

E-119 Physical and Chemical Environment

E-120 Noise

Few alternatives can reduce the noise generated by the construction and operation of the Waterway. Construction schedules should be designed to use only the daylight hours, avoiding the sensitive nighttime hours when people sleep. Weekend construction activities should be minimal especially near recreation facilities which are likely to have heavy usage. Temporary haul and access roads should be routed to avoid sensitive areas such as schools and residential communities. During operation it is expected that the low speeds of the ship and boats using the Waterway will reduce noise levels to as low as possible. The use of horns or bells by the ships should not be permitted except in emergencies.

The noise generated in residential areas by the rerouting of the Penn Central-Erie Lackawanna Railways can be effectively reduced by routing these tracks to the east, rather than south, to join with the lines connecting North Tonawanda with Lockport (see E, Figure E-9). The junction of this proposed rerouting with existing lines would be in the vicinity of Shawnee and Townline roads.

E-121 Air Emissions

Construction-vehicle traffic can create a dust and a combusion-product-emission problem. Regular wetting of temporary haul and access roads will reduce the fugitive dust problem. Temporary roads should not be paved or oiled because of the difficulties in reclamation at the end of construction. It is assumed that by the beginning of construction, vehicle emission-control devices will result in minimal emission. Some increase over the ambient air-pollution levels cannot be prevented simply because of the magnitude of construction vehicle traffic.

Vegetation removed from the Waterway right-of-way and construction debris should not be processed by open burning. Controlled incineration or proper disposal in a sanitary land fill will reduce air emissions during construction.

During Waterway operation, the majority of emissions to the air will result from the ships. Low operating speeds and the use of

emission-control devices on the engines are expected to minimize the impact.

E-122 Excavation and Disposal of Construction Materials

Large quantities of material removed from the overland cut south of the Niagara Escarpment will be effectively disposed of in the dikes. Should the actual amounts of cut material exceed the requirement for the dikes, the bottom of the surge basins can be used as a depository. The alignment of the surge basin for Lock 1-5 has been altered to better accommodate, particularly near the lock itself, any excess material (see R, Figure E-9). All locks could be altered similarly to accommodate all excess material so no spoil or waste areas would be required. Topsoil removed from the overland cut should be placed on the slopes and tops of the dikes to facilitate the growth of vegetation on these surfaces. Such growth will inhibit erosion and improve the appearance of the dikes.

All debris resulting from construction should be removed from the construction zone and discarded as discussed under Air Emissions.

E-123 Alteration of Groundwater Systems

If groundwater seepage into the Waterway (primarily in the section cut below the surface of the natural terrain south of the Escarpment) reduces aquifer yields or subsurface soil moisture, measures should be taken to control such seepage. Methods include grouting or sealing the walls through which the seepage occurs and pumping water from the Waterway back into the aquifer.

E-124 Relocation and Disturbance of Transportation Routes

While 10 existing roads will deadend at the Waterway, these roads carry comparatively little traffic and will be connected to routes which do cross the canal. The construction of more bridges will create additional noise, aesthetic, and relocation impacts. The proposed La Salle and Belt Expressways and the Lake Ontario State Parkway will cross the Waterway over a new bridge for the express ways and through an existing tunnel for the parkway.

It is suggested that Simmons Road be rerouted to connect with Route 104 to improve access to Bond Lake and to residences in that area (see M, Figure E-9). The proposed relocation of Lock 2-5 (see N, Figure E-9) and the accompanying tunnels for the Penn Central Rail line (see P, Figure E-9) and State Highway 93 (see Q, Figure E-9), while increasing the distances involved in travel and the amount of new construction required, will permit the moving of Lock 2-5 closer to the Escarpment for an improvement in aesthetics and reduce the transportation induced noise levels in Ransomville.

The proposed rerouting (see G, Figure E-9) of the Waterway near the Escarpment will preserve Meyers Hill Road which the original alignment eliminated. This will slightly reduce the disruption due to the blocking of roads by the canal.

E-125 Dredging and Spoil Disposal

Dredging the Niagara River channel for the Waterway will cause some unavoidable but temporary increase in turbidity. Several alternatives for disposal of the dredged spoil include: (1) on the canal dikes, (2) in diked spoil disposal lagoons, (3) in Lake Erie, (4) as artificial reefs in the Niagara River, and (5) in the bottoms of the surge basin. It may be necessary to utilize all five alternatives to minimize the adverse impacts and develop a potential benefit. Hard, coarse material, such as the dolomite fragments resulting from cutting the channel through bedrock, can probably be safely disposed of in deeper (>40 feet) Lake Erie waters. These rock fragments will settle quickly and create only minor turbidity as they strike the bottom. Impacts on aquatic biota whose densities are quite low in the open, deeper water zones of Lake Erie will be minimal. Another disposal site for the coarse rock would be in the Niagara River channel where an artificial reef could be created providing a sheltered fish spawning and feeding habitat - a net benefit. The rock could also be placed in the dikes north of the Escarpment. However, if the materials would be transported overland by trucks, traffic and noise impacts would be incurred. The finer spoil material, which would create turbidity if dumped in open water, can best be disposed of in the bottoms of the surge basins, on the above water portion of the artificial reefs, or in diked disposal lagoons. Those spoil materials from the polluted inshore (east bank) areas of the Niagara River East which have a high BOD and contain toxic materials (e.g., heavy metals, grease and oil) can best be disposed of in the dikes or in diked disposal lagoons where containment can be assured. Such disposal of spoil may, however, result in odor problems.

E-126 Waterway Water Quality

The current good quality of water in the main channel of the Niagara River and the expected improvement in the quality of water in creeks discharging from the east bank of the river should insure the Waterway a good supply of good quality water. However, should water-quality standards not be met and these creeks continue to discharge highly polluted water, much of it may be channelled into the canal. Under these circumstances, a barrier constructed south from the point where the Waterway goes overland may be effective in keeping the polluted water, which hugs the eastern bank of the river, from entering (see A, Figure E-9). However, to prevent a buildup of polluted water behind the barrier, the water may have to be pumped across the mouth of the Waterway and discharged to the Niagara River downstream from the Waterway mouth. Discharge of domestic, municipal, and industrial wastes into the Waterway should be prohibitied.

It is assumed that no ship or boat will discharge sewage or other wastes into the Waterway.

Some unavoidable solar heating of the water and turbidity, due to water movement through the surge basins when the locks are operated, are expected.

E-127 Surface Drainage Patterns

The Waterway will cut about 13 square miles from the Bergholtz Creek drainage basin. This reduction in the quantity of water in Bergholtz Creek downstream from the Waterway reduces the amount of water available for use. Controlled replacement of this lost water can be made by pumping Waterway water into the creek. This controlled pumping may improve Bergholtz Creek since, during the drier portions of the year, flows are naturally reduced, limiting its capability to absorb the water discharged to it. Augmenting the low flows would maintain or increase the potential for usage by man.

E-128 Runoff From Construction Areas

Runoff from the considerable expanse of unvegetated land within the construction buffer zone during heavy rainfall will create a turbidity problem north of the Escarpment in the streams and creeks as well as Lake Ontario where they discharge. It is recommended that a series of ditches and culverts be constructed to channel construction buffer zone runoff parallel to the Waterway route to temporary settling basins located within the construction buffer zone (see S,

Figure E-9). The water from these basins can be safely treated and discharged to Twelvemile Creek which discharges into Lake Ontario.

E-129 Ecological Environment

E-130 Loss of Natural Vegetation

The Waterway will unavoidably remove small quantities of natural vegetation. Rerouting the canal would not significantly alter this impact. The existing route avoids the Tuscarora Indian Reservation where much of the natural vegetation in the Western portion of Niagara County is located.

E-131 Loss of Productive Agricultural Land

The predominant agricultural lands affected by the Waterway are orchards and vineyards, pasture, and highly productive vegetable cropland. Because of the expanse of orchards, vineyards, and pastures in Niagara County, little can be done to reduce the acreage removed by the Waterway.

The productive, well-developed vegetable cropland is localized and the acreage affected can be significantly reduced by rerouting as shown in Figure E-9 (see G). With this realignment the Waterway will pass along the edge of this cropland rather than through the center. To further mitigate adverse impacts on this cropland, a means of controlling the drainage of soil moisture into the Waterway should be developed which is compatible with the existing and proposed tile drainage system for these soils. Techniques include sealing the soil near the Waterway edge to prevent seepage, control pumping water into the soils to replace lost moisture, and the use of drainage tile system discharging into the Waterway and a gate to channel and control the seepage. Consultation with the Soil Conservation Service during the design phase of the Waterway would insure the selection of the best alternative.

E-132 Loss of Wildlife

The removal of natural vegetation and agricultural land constitute a loss in wildlife habitats and a corresponding loss of wildlife

that rely on this land for breeding, feeding, and nesting or denning. This loss of terrestrial wildlife is unavoidable.

The surge basins and Waterway will provide some additional habitat for waterfowl to use as a resting area. The planting of appropriate emergent aquatic vegetation along the margins of the surge basins would improve this habitat for waterfowl. However, the turbulence in the surge basin as water enters or leaves and the fluctuating water level, are not expected to permit their development into high-quality waterfowl habitats.

E-133 Temporary Displacement of Wildlife

During construction, the presence of large numbers of workers, vehicular traffic, and noise will displace wildlife located nearby. Measures short of drastically reducing the size of the construction force will do very little to reduce this impact.

E-134 Loss of Aquatic Biota

The dredging required for the Niagara River channel and the harbor out into Lake Ontario will destroy rooted aquatic vegetation and benthic organisms located in the dredged areas. Toxic sediments stirred up during dredging may kill some fish and plankton. These impacts are unavoidable.

Measures discussed in Paragraph E-125, Dredging and Spoil Disposal, can be taken in disposing the dredge spoil to prevent further impacts to the aquatic biota or even provide a benefit in the construction of a reef for a feeding and, perhaps, breeding habitat.

E-135 Social Environment

E-136 Disruption of Transportation and Interaction Networks

A barrier imposed to transportation and interaction networks by the Waterway is unavoidable. The eight crossings provided will minimize the social impacts. To improve this network the temporary access road on the east side of the Waterway could be converted at the end of construction, into a paved parkway which would improve

the north-south highway system (see D, Figure E-9). In so doing, care should be taken that significant construction impacts are not incurred in the building of this route.

E-137 Burden on Public Services By Temporary Construction Force

Local governments should be paid both for temporary and permanent impositions upon the community infrastructure that will not be effectively paid for by the immigrant work force. This is especially important for schools, hospital and medical services, police and safety protection, etc. Also included in this concern is that "in lieu of tax" payments be made for the approximately 10,000 acres removed from local tax rolls.

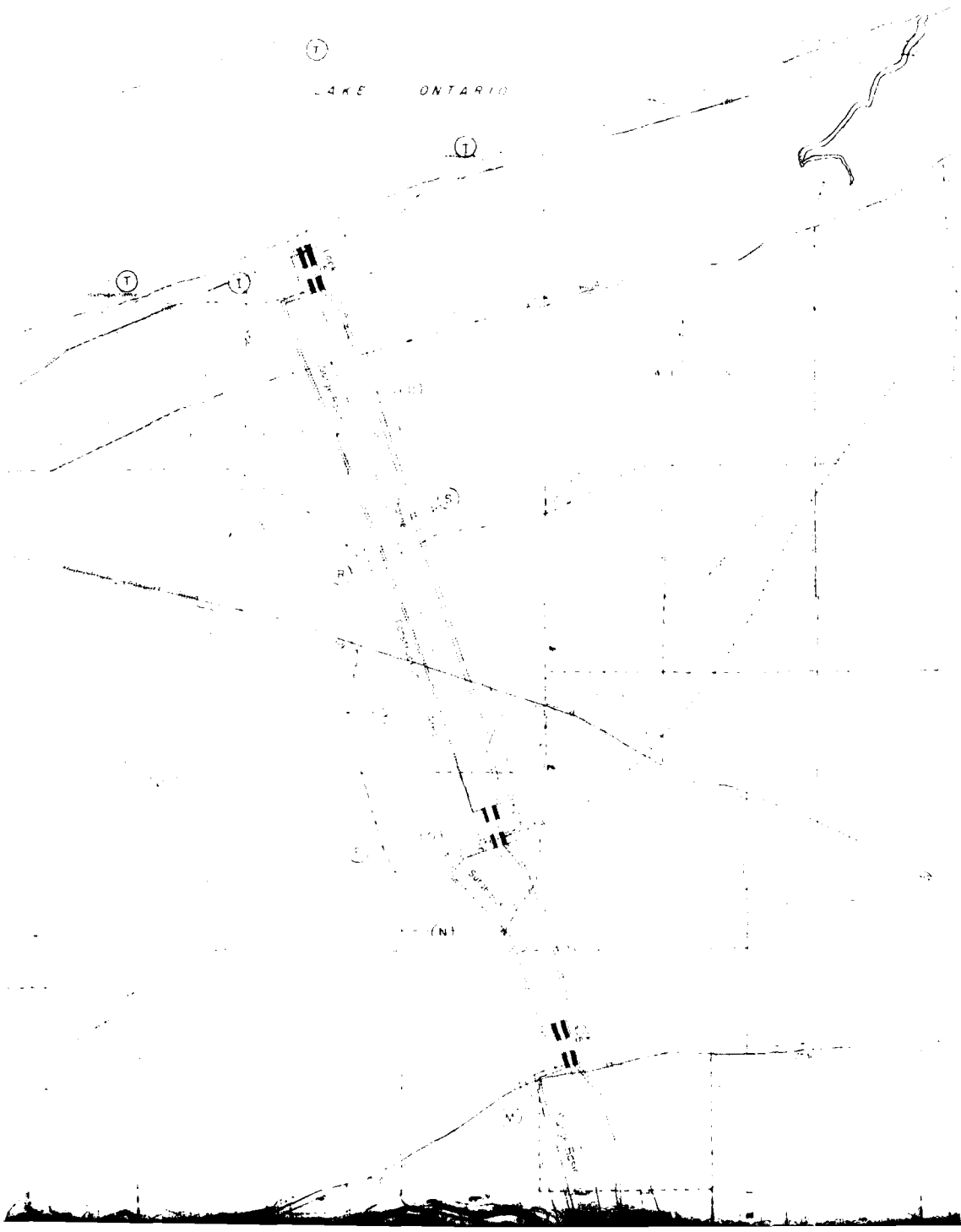
Payments in lieu of taxes may be critically important if property is condemned by the Corps of Engineers, but former owners are permitted occupancy but not required to pay property taxes. In addition, if habitable dwellings are available close to the construction sites, there is a strong likelihood that present single-family dwellings may become multiple-family dwellings.

The best suggestion for dealing with these uncertainties of financial support of overburdened infrastructure, would be to enter into an agreement with local units of government, perhaps through a suggested canal commission (see Paragraph E-141) that would insure that appropriate financial assistance would come from the Federal Government if significant temporary burdens were placed upon the communities.

Specifically, the sewage-treatment plant and the high school and athletic campus proposed for development on Squaw Island should be resited, as an incumbent responsibility with development of the project.

E-138 Increased Regional Income and Retail Trade During Construction

A detailed study should be undertaken to assess regional economic implications of temporarily increased income and retail trade. The implications of these trends should be communicated through such local organizations as the Regional and Economic Development


LAKE ONTARIO

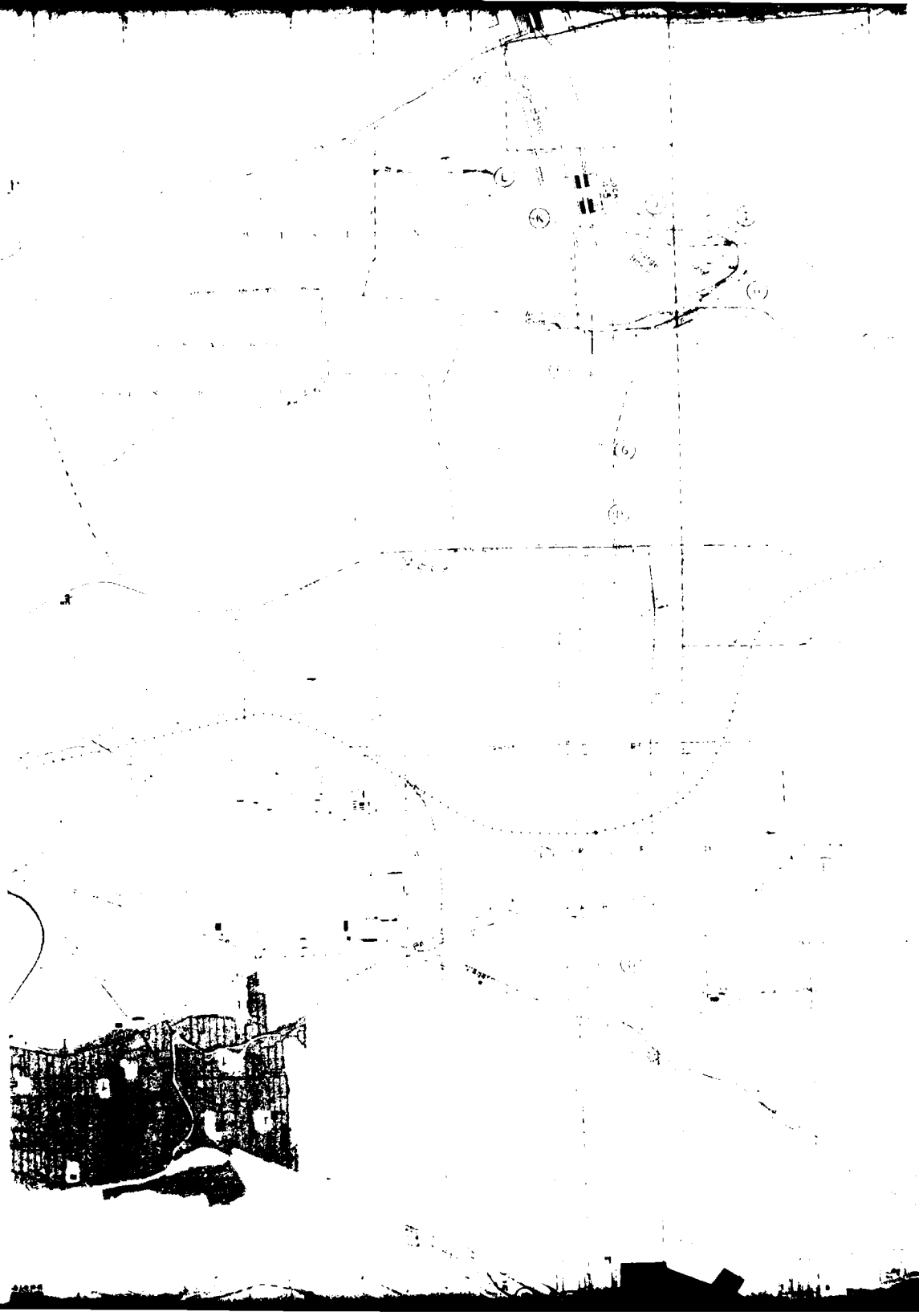


FIGURE E-9. MAP OF PHYSICAL CHANGES PROPOSED FOR THE LE-LO WATERWAY BY THE ENVIRONMENTAL AND RECREATIONAL PLAN. LETTERS ON MAP ARE KEY TO THE LETTERS IN TABLE E-32.

Commission of Niagara County and area Chambers of Commerce. Such communication will inform the local businesses of the temporary nature of the increase in trade and prevent false economic expectations.

E-139 Loss of Property Taxes

Arrangements should be made to compensate local units of government for the acreage taken from the tax rolls on a sustained (rather than one-time) basis, at a level sufficient to provide local governmental units with operating revenue equivalent to that of periods before construction of the Waterway.

E-140 Change in Population Makeup Due to Influx of Construction Workers

Short of hiring most of the construction workers locally, this impact is unavoidable. It is doubtful that the area could, under normal circumstances, supply several thousand construction workers. However, it is suggested that when possible, the Corps should encourage its contractors to employ local labor. This is so that those impacted by the proposed developments will receive some benefits from it as well.

E-141 Relocation and/or Damage of Individual Residences and Businesses

Recognizing that these impacts represent an area that has been dealt with inadequately in the past, it is suggested that in addition to, or in lieu of the usual realtor-defined value determination of condemned property, a commission be established with representatives from the local community, the U.S. Army Corps of Engineers, HUD, or other pertinent housing or agricultural agencies, to insure that a fair settlement is obtained for families forced to relocate by development of the project. Sufficient payment and options should be made available to local residents forced to relocate as a result of development of the project. The Corps should be willing to move present houses to new sites assuming comparable costs, if that is the desire of property owners.

It is suggested that a bond should be put up either by the Corps, or required of their respective contractors to insure that mechanisms

and dollars will be available to compensate local citizens for damage incurred as a result of Waterway-related activities. Particularly, these monies should provide compensation for structural damage to dwelling units impacted by construction, as well as such things as temporary housing of residents forced to relocate temporarily from impacts suffered as a result of construction activities.

E-142 Public Participation

Because of the magnitude of the Waterway Project and the impacts it has on the people of Niagara and Erie Counties, the incorporation of the public in the planning process is essential. Every effort should be made to develop a community advisory group with selected authority to study and recommend changes in the route, construction techniques, or associated spin-off problems. They should also consider institutional techniques, relocation procedures, and compensation, etc. It is suggested that this group be created immediately upon receiving Congressional approval to go ahead with either detailed planning of the project or actual construction.

In addition to provisions being made for public involvement in implementing elements of the project, it is recommended that in order for such efforts to be meaningful, there should be a series of community education workshops. These workshops would present information that would create an understanding of the implications involved in implementation of various elements of the Waterway. Only when such information was understood by the community, local decision makers, and agency representatives could common decisions/concensus be achieved realistically with any validity.

E-143 Recreational and Cultural

E-144 Loss of Acreage in Three Existing Recreational Facilities

Loss of land in Riverview Park for Waterway construction could be ameliorated by acquiring adjacent land including that now occupied by the highway and railroad scheduled for relocation (see B, Figure E-9). The loss of park acreage at Bond Lake could be prevented if the surge basin for Lock 4-5 were placed on the east rather than the west side and the lock-operating facilities moved to the east side

of the Waterway (see J, Figure E-9). Such changes would also require the relocation of Route 429 (see H, Figure E-9). We recommend that new park lands be acquired to compensate for the loss or substantial reduction of Oppenheim Park. Desirable sites for the new park lands might be located along the railroad line in Wheatfield to be abandoned (see C, Figure E-9). A preferred location is the intersection of the railroad right-of-way and the proposed open space corridor along Bergholtz Creek.

E-145 Loss of Proposed Recreational Facilities

Damage to the proposed park along Sixmile Creek could be minimized by careful location and construction of the tunnel carrying Youngstown Road and the proposed Lake Ontario Parkway under the Waterway. No specific amelioration can be suggested for the loss of proposed recreational open space on Squaw Island except for acquisition of an equivalent site for the proposed Squaw Island high school campus including a playing field-sports area.

Interruptions in east-west, open-space corridors, such as the proposed Niagara Escarpment Trail and the Cayuga-Bergholtz Creek corridor, can be minimized if specific crossing facilities are provided. The Escarpment Trail can perhaps best be accommodated by a walkway atop the gates of Lock 4-5, north of Upper Mountain Road. The Cayuga-Bergholtz Creek corridor will require specific provision of hiking-biking space in the bridge carrying Route 62 over the Waterway. The attractiveness of these corridors will remain somewhat reduced due to the close association with highway and Waterway traffic.

E-146 Recreational Opportunities Offered by the Waterway

The Waterway and its associated facilities present several opportunities to develop new recreational facilities, including:

- A scenic parkway along the east shore of the Waterway connecting the proposed La Salle Expressway to Lake Ontario Parkway. The access and haul roads used during construction could be developed for this use (see D, Figure E-9 for routing suggestions).

- A hiking-biking corridor could parallel the west shore of the Waterway, providing an important north-south link between proposed east-west corridors such as the Niagara Escarpment Trail and the Cayuga-Bergholtz Creek corridor (see F, Figure E-9).

- A new hiking-corridor could be developed on the railroad right-of-way to be abandoned, between Riverview Park and Walmore (see C, Figure E-9).

- A visitor center and observation area could be developed to interpret Waterway operation and local features of historic or natural interest. A location near Lock 4-5 on the Escarpment would be an effective focal point for visitor interest (see K, Figure E-9).

- If the Waterway operations center is located near either endpoint or at a lock, a second visitor center area could be developed, providing tours of the operations control room.

- Waterway breakwaters into Lake Ontario could be developed to accommodate fishermen (see T, Figure E-9).

- Fishing in surge basins could be aided by providing minor facilities for improved public shore access.

- Picnic and observation areas could be located at the Lake Ontario shore and at any other points of interest such as near locks and surge basins when Waterway design permits (see I, Figure E-9).

- Dikes could be landscaped to facilitate sledding use. In the Escarpment area, cut material might be used to shape a short ski slope (see L, Figure E-9).

- If the Waterway route were shifted to the east in the Bond Lake area (see G, Figure E-9), and if the surge basin were placed on the east side (see J, Figure E-9), additional land could be developed, particularly for camping, adjacent to the Bond Lake Park.

- A hiking corridor could be developed on the portion of the Penn Central line to be abandoned between Sanborn and Lockport Junction (see E, Figure E-9).

E-147 Visual Impact of Massive Dikes and High Bridges

The major visual impact occurs where the waterway passes near Ransonville. Here the dikes are approximately 100 feet high. The relocation of Lock 2-5 about 1.3 miles closer to the Niagara Escarpment (see O, Figure E-9) will reduce the height of the dikes near Ransonville some 80 feet to about 20 feet high. It is also suggested that shrubs and small trees be planted on the tops and outer sides of the dikes to improve their appearance. The aesthetic impacts of the proposed highway and rail bridges are major. Although some mitigation is possible through terracing, planting of vegetative cover, and screening, they will remain obvious.

E-148 Reduction in Recreational Use of the Welland Canal

No suggestions for ameliorations can be offered for the reduction in recreational use of the Welland Canal.

E-149 Loss of Educational/Scientific Sites

Moving the surge basin associated with Lock 4-5 to the east of the Waterway will preserve Bond Lake and the opportunities for continuing the scientific study of the aquatic life there. The Waterway also creates the possibility for "before" and "after" studies of the effects of man and his actions on both aquatic and terrestrial ecosystems. Such studies would be of basic scientific importance as well as of value to the final, detailed assessment of the environmental changes caused by this project.

Visitor centers will also provide an opportunity to educate the public concerning the design and operation of the Waterway as well as other interesting information about the general route.

E-150 Potential Excavation of Archeological Sites

Sites of prehistoric activity and use by Indians may be found in the course of building the Waterway. The excavation, study, and display (in museums and the visitor centers) of artifacts found at such sites would contribute to archeological knowledge as well as tourist and visitor interest in this region. Such excavations should be performed by qualified experts to insure the recovery of as much valuable information and material as possible.

E-151 Disruption of Historical Atmosphere of Bergholtz

The disruption of the historical atmosphere of Bergholtz by the canal can be reduced to some extent by planting tall trees along the Waterway edge to shield the community from its sight and sounds. A portion of this atmosphere might be captured in the visitor center using an interpretive historical narrative as well as examples of clothing, tools, etc., representative of the era when Bergholtz was settled.

E-152 Unavoidable Adverse Impacts

Several adverse impacts resulting from the construction and operation of the Waterway cannot be eliminated. These unavoidable impacts are summarized in Table E-33. Noted that of the 26 adverse impacts identified for the unmodified Waterway project, 15 could not be eliminated by the changes recommended in the environmental and recreational plan. Of these 15 impacts, 10 were reduced in magnitude by the plan. The magnitudes of the remaining 5 impacts are not great. No project, particularly one of this magnitude, can be built and operated without incurring some significant environmental impacts. The decision to build an LE-LO Waterway can be made only after comparing the need for the project, the economic benefits and costs, and the environmental benefits and costs (non-dollar) to determine if the outcome is a net benefit to all concerned.

TABLE E-33. SUMMARY OF UNAVOIDABLE ADVERSE IMPACTS

Noise*
Air pollution*
Disruption and relocation of transportation routes*
Turbidity and temperature increase in Lake Ontario
Loss of natural vegetation
Loss of cropland*
Loss of wildlife
Displacement of wildlife
Loss of aquatic biota
Social barrier via transportation blockage*
Change in population makeup due to influx of construction workers*
Relocation of people and businesses*
Disruption of historical atmosphere of Bergholtz*
Loss of existing recreational acreage*
Loss of proposed recreational acreage*
Loss of aesthetic quality*

*Indicates plan has achieved some reduction in impact no elimination.

REFERENCE LIST

1. Erie and Niagara Counties Regional Planning Board. 1972. Erie and Niagara Counties comprehensive solid waste study. 2 vols. Various paging. (Prepared by Camp Dresser and McKee).

2. U.S. Geological Survey. 1965. Topographic sheets for Ft. Niagara, Sixmile Creek, Wilson, Lewiston, Ransomville, Cambria, Niagara Falls, Tonawanda West, Tonawanda East and Buffalo North-West, 7.5 minute.

3. Pearson, C. S., et al. Sept., 1947. Soil survey - Niagara County, New York. U. S. Department of Agriculture, Agricultural Research Administration in cooperation with the Cornell University Agricultural Experiment Station. Series 1937, No. 30. 74 p.

4. Johnston, R. H. 1964. Ground water in the Niagara Falls area, New York. State of New York Conservation Department, Water Resources Commission. Bulletin GW-53. 93 p.

5. LaSala, A. M., Jr. 1968. Ground-water resources of the Erie-Niagara Basin, New York. State of New York Conservation Department, Water Resources Commission. Report ENB-3. 123 p.

6. U.S. Geological Survey. 1970. Surface water supply of the United States - 1961-1965. Water-supply paper-1904, Part 2, Vol. 1. U.S. Government Printing Office, Washington, D. C.

7. Erie and Niagara Counties Regional Planning Board. Jan., Feb., Mar., 1972. Stream classification and quality standards for water pollution control. Erie and Niagara Counties Regional Planning Board Newsletter 3(7-9): 1-5.

8. Van Lier, M. W. Apr., 1973. Temporal changes in selected chemical variables occurring in Elliot Creek of the Niagara River Basin, Western New York. Abstracts of the 16th Conference on Great Lakes Research, Huron, Ohio. April 16-18, 1973.

9. Harding, W. E., B. K. Gilbert, R. M. Beall. 1968. Surface water in the Erie-Niagara Basin, New York. State of New York Conservation Department, Water Resources Commission. Report ENB-2. 130 p.

10. Dee, Norbert, et al. Jan., 1972. Environmental evaluation system for water resource planning. U. S. Department of the Interior, Bureau of Reclamation. Contract No. 14-06-D-7182. Battelle Memorial Institute, Columbus Laboratories, Ohio.

11. Maylath, R. E. (Chief, Water Quality Management). Apr., 1973. New York State Department of Environmental Conservation, Bureau of the Water Quality Management. (Personal communication.)

12. Erie and Niagara Counties Regional Planning Board. Nov., 1971. International environmental study, environmental enhancement of the Niagara River. Technical report. 392 p.

13. U.S. Army Corps of Engineers. Apr., 1970. Dredging water quality problems in the Great Lakes. Vol. 1. Summary report. Various paging.

14. U.S. Department of Commerce, Weather Bureau. 1964. Climatic summary for State of New York, 1951-1960. Climatography of U.S. Series 86-26. U.S. Government Printing Office, Washington, D.C.

15. Davis, Edward, et al. Jan., 1972. Implementation plan to achieve air quality standards, upstate New York; particulate matter, sulfur dioxide, carbon monoxide, hydrocarbons, oxidants, nitrogen dioxide. New York State Department of Environmental Conservation, Albany, N. Y. 310 p.

16. U.S. Environmental Protection Agency. Dec., 1971. Report to the President and Congress on noise. U.S. Environmental Protection Agency Special Report NRC500.1. 469 p.

17. Erie and Niagara Counties Regional Planning Board. June, 1970. Initial environmental study. 87 p.

18. Heineman, D. T. Jan., 1973. Erie and Niagara Counties Regional Planning Board. (Personal communication.)

19. Zenkert, Charles A. Aug., 1934. The flora of the Niagara Frontier region. Bulletin of the Buffalo Society of Natural Sciences. Vol. 16. 328 p.

20. U.S. Department of Commerce, Bureau of the Census, Social and Economic Statistics Administration. May, 1972. 1969 Census of agriculture. Part 7. New York. Vol. 1, Section 1, 306 p. Section 2, 464 p.

21. Peas, R. (Fruit Specialist). Apr., 1973. County Agriculture Extension Office, Lockport, N. Y. (Personal communication.)

22. Burt, W. H., R. P. Grassenheider. 1964. A field guide to the mammals. 2d Ed. Houghton Mifflin Company, Boston, Mass. 284 p.

23. Cornell University. (1973). LUNR land use acetate overlays for USGS topo maps, areas 2786, 2787, 3186, 3187, 3287, 3086, 3087, 3286. Land Use and Natural Resource Inventory of New York State. Cornell University, LUNR User Service, Ithaca, N. Y.

24. Cheney, Russel (Senior Wildlife Biologist). Apr., 1973. U.S. Fish and Wildlife Service, Olean, N. Y. (Personal communication.)

25. Robinson (County Agricultural Agent). Apr., 1973. Niagara County, Lockport, N. Y. (Personal communication.)

26. Beardslee, Clark S., Harold D. Mitchell. 1965. Birds of the Niagara Frontier region. An annotated checklist. Bulletin of the Buffalo Society of Natural Sciences, Buffalo, N. Y. Vol. 22, 478 p.

27. Bellrose, Frank C. 1968. Waterfowl migration corridors east of the Rocky Mountains in the United States. Illinois Natural History Survey, Biological Notes. No. 61. 24 p.

28. Bailey, E. W. Sept., 1961. Preliminary report on fish and wildlife resources in relation to the Lake Erie and Lake Ontario, New York Waterway project. U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Boston, Mass. 3 p. (Letter).

29. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Dec., 1968. Rare and endangered fish and wildlife of the United States. Resource Publication No. 34, Washington, D.C.

30. Conant, Roger. 1958. A field guide to reptiles and amphibians of Eastern North America. The Riverside Press, Houghton Mifflin Co., Boston, Mass.

31. U.S. Environmental Protection Agency. Region V. Aug., 1971. Lake Erie, Ohio, Pennsylvania, New York intake water quality summary 1970. (In cooperation with Ohio Department of Health, New York State Department of Environmental Conservation, and Pennsylvania Department of Environmental Resources.) Washington, D.C., U.S. Government Printing Office. 312 p.

32. Munawar, M., A. Nauwerck. 1971. The composition and horizontal distribution of phytoplankton in Lake Ontario during the year 1970. Pp 69-78. In: Proceedings of the 14th Conference on Great Lakes Research, International Association for Great Lakes Research. University of Toronto, Ontario, Apr. 19-21, 1971. Braun Frumfield Inc., Ann Arbor, Mich.

33. International Joint Commission. 1970. Pollution of Lake Erie, Lake Ontario, and the international section of the St. Lawrence River. Ottawa, Queen's Printer. 105 p.

34. Beeton, A. M. 1965. Eutrophication of the St. Lawrence Great Lakes. Limnology and Oceanography 10: 240-254.

35. Williams, Louis G. 1962. Plankton population dynamics. U.S. Department of Health, Education, and Welfare, U.S. Public Health Service Publication No. 663. Suppl. 2. 90 p.

36. Watson, N. H. F., G. F. Carpenter. 1973. Crustacean zooplankton on Lakes Huron, Erie, and Ontario. Abstracts of the 16th Conference on Great Lakes Research, International Association for Great Lakes Research, Huron, Ohio. April 16-18, 1973.

37. Davis, Charles C. 1966. Plankton studies in the largest Great Lakes of the world. Great Lakes Research Division, Institute of Science and Technology, Publication No. 14. 36 p.

38. Sweeney, Robert A., Charles Merckel. 1972. Survey of benthic macroinvertebrates and analysis of water and sediments from the Buffalo River. Great Lakes Laboratory, State University College at Buffalo, Special Report No. 14. 26 p.

39. Brinkhurst, Ralph O. 1969. Changes in the benthos of Lakes Erie and Ontario. Pp 45-65. In: Proceedings of the Conference on Changes in the Biota of Lakes Erie and Ontario. Robert A. Sweeney (Ed.). Bulletin of the Buffalo Society of Natural Science, Vol. 25, No. 1, 84 p.

40. Scheirer, Robert. Apr., 1973. U.S. Fish and Wildlife Service, Concord, New Hampshire. (Personal communication.)

41. Cristie, W. J. 1972. Lake Ontario: Effects of exploitation, introductions, and eutrophication on the salmonid community. Journal of Fisheries Research Board, Canada, 29: 913-929.

42. Regier, H. A., V. C. Applegate, R. A. Ryder. 1969. The ecology and management of the walleye in Western Lake Erie. Great Lakes Fisheries Commission. Technical Report No. 15. 101 p.

43. New York State, Office of Statistical Coordination. 1972. New York State Statistical Yearbook, 1972. New York State Division of the Budget/Office of Statistical Coordination, Albany, New York.

44. U.S. Department of Commerce, Bureau of the Census. 1972. 1970 Census of population, general social and economic characteristics, New York. U.S. Department of Commerce, Social and Economic Statistics Administration, Bureau of the Census, Population Division. U.S. Government Printing Office, Washington, D.C.

45. Schwartz, Fichtner, Bick and Associates. 1970. Community Renewal Program, Niagara Falls, New York. Housing Report. Schwartz, Fichtner, Bick and Associates, A Division of Raymond, Parish and Pine, Inc. 48 p.

46. Schwartz, Fichtner, Bick and Associates. 1972. Community Renewal Program, Niagara Falls, New York. Population. Unpublished Report.

47. Schwartz, Fichtner, Bick and Associates. 1971. Community Renewal Program, Niagara Falls, New York. Economic Report. Schwartz, Fichtner, Bick and Associates, A Division of Raymond, Parish and Pine, Inc. 67 p.

48. Myers, Lawrence B. (Barton-Aschman Associates, Inc.) June, 1969. The Buffalo Standard Metropolitan Statistical Area: Economic and demographic analyses and projections, 1966/67 - 1990. Vol. 1. Overall findings. Prepared for the Erie and Niagara Counties Regional Planning Board. Buffalo, New York.

49. Erie and Niagara Counties Regional Planning Board, Grand Island, New York. Unpublished data.

50. U.S. Department of Commerce, Bureau of the Census. July, 1972. Statistical abstract of the United States, 1972. 93d Annual Edition. U.S. Department of Commerce, Social and Economics Statistics Administration, Bureau of Census. U.S. Government Printing Office, Washington, D.C. 1017 p.

51. U.S. Department of Commerce, Bureau of the Census. 1963. 1960 Census of population, general social and economic characteristics, New York. U.S. Department of Commerce, Social and Economic Statistics Administration, Bureau of the Census, Population Division. U.S. Government Printing Office, Washington, D.C.

52. U.S. Department of Commerce, Bureau of the Census. May, 1972. 1970 Census of population and housing: Census tracts, PHC(1)-35. Buffalo, N. Y., Standard Metropolitan Statistical Area. U.S. Government Printing Office, Washington, D.C. 148 p.

53. U.S. Department of Commerce, Bureau of the Census. 1967. County and city data book; (a statistical abstract supplement). U.S. Government Printing Office, Washington, D.C. 673 p.

54. Lomenzo, John P. (Secretary of State). 1970. New York Legislative Manual Vol. 144. State of New York, Albany, New York. 1056 p.

55. Kiwanis Clubs of Stamford, Ontario, Inc. 1967. Niagara Falls, Canada, a history of the city and the world famous beauty spot. Ryerson Press, Toronto. 452 p. (Second printing, Apr., 1968).

56. U.S. Department of the Interior, National Park Service. 1970. The national register of historic places. U.S. Government Printing Office, Washington, D.C. 352 p.

57. Barton-Aschman Associates, Inc. Aug., 1969. Parks, recreation and open space study and plan. A technical report prepared for the Erie and Niagara Counties Regional Planning Board. 195 p.

58. Ontario Department of the Environment. 1972. Niagara Peninsula Conservation Report. Vol. 1.

59. Division of Planning. Nov., 1968. Recreation and open space plan, Buffalo master plan.

60. Erie and Niagara Counties Regional Planning Board. May, June, July, 1971. Planning board presents proposed regional plan for review. Newsletter 2(11-12): 1-6.

61. Regional Municipality of Niagara. Nov., 1971. Official plan studies. Report No. 3. Environment: research and analysis. 102 p.

62. Regional Municipality of Niagara. July, 1972. Official plan studies. Report No. 11. Potential recreation areas and fragile biological sites. 88 p.

63. Erie and Niagara Counties Regional Planning Commission. Mar., 1973. Preliminary draft of population projections.

64. Regional Municipality of Niagara. Feb., 1972. Official plan studies. Report No. 8. Community facilities.

65. St. Catherines Chamber of Commerce. 1970. Report on tourism. 14 p. (Unpublished)

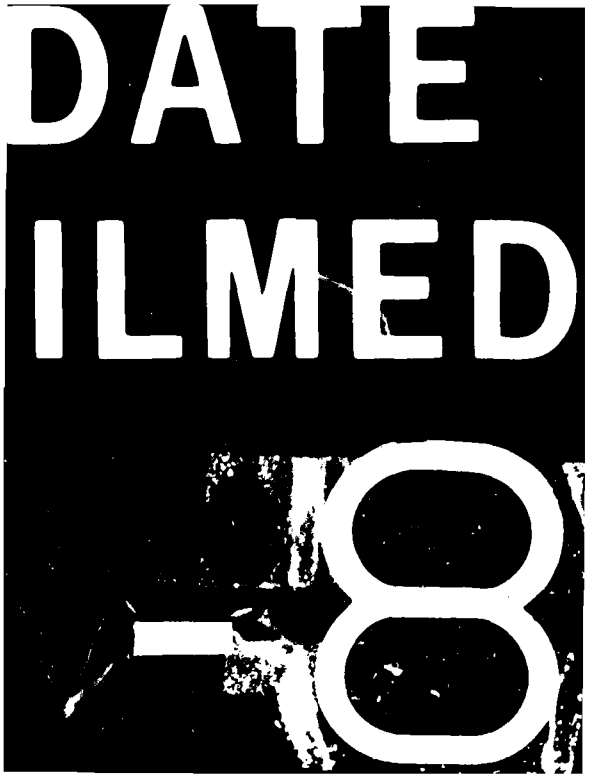
66. Hartman, W. L. 1972. Lake Erie: effects of exploitation, environmental changes, and new species on the fishery resources. J. Fish. Res. Bd. Canada 29: 899-912.

67. U.S. Atomic Energy Commission, Directorate of Licensing. 1973. Draft environmental statement related to the R. E. Ginna Nuclear Power Plant, Unit No. L. Rochester Gas and Electric Corp. Docket No. 50-244.

68. U.S. Department of Agriculture, Soil Conservation Service. 1972. Soil survey of Niagara County, New York.

69. Sweers, H. E. 1969. Structure, dynamics, and chemistry of Lake Ontario. Manuscript Report Series No. 10. Department of Energy, Mines, and Resources, Ottawa, Ontario, Canada.

70. Isard, Walter. 1960. Methods of regional analysis: an introduction to regional science. MIT Press, Cambridge, Mass.


DATE
ILMED
-8